ESD-TR-66-672

PRIMER FOR AIR FORCE ADP EXPERIENCE HANDBOOK (PILOT VERSION)

December 1966

TACTICAL PLANNING DIVISION
DIRECTORATE OF PLANNING AND TECHNOLOGY
ELECTRONIC SYSTEMS DIVISION
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
L. G. Hanscom Field, Bedford, Massachusetts

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FOREWORD

This primer was prepared by the Information Systems Division of Planning Research Corporation, Los Angeles, California, under contract number AF 19(628)-5988, project number 7990. The Air Force Project Officer was Major George H. Montague, Electronic Systems Division, ESLT. Work on the project was performed under the direction of Alan J. Gradwohl, PRC Project Manager, from 16 February 1966 to 15 December 1966, with George S. Beckwith in charge of producing the primer. Other contributors providing significant assistance in preparing this primer include:

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ABSTRACT

This primer illustrates the use of the Air Force ADP Experience Handbook (Pilot Version) published under separate cover as ESD-TR-673 (PRC R-930). The use of the handbook is illustrated by first preparing a sample ADPS proposal and subsequently evaluating the proposal with experience data retrieved from the handbook. The sample ADPS proposal is written to a set of ADPS proposal submission instructions that are advanced as an improvement over existing submission instructions. The ADPS proposal submission instructions are included in the primer for completeness. The sample ADPS proposal is for a Major Air Command Centralized Military Pay System. The proposal is hypothetical in intent and content but has correspondence to a number of existing Air Force systems and procedures. Evaluation of the sample proposal involves first obtaining cost estimates and relevant experience data from the experience handbook. After all experience data relevant to the proposed ADPS has been retrieved, the sample ADPS proposal is evaluated in light of the retrieved data. The data in the pilot version experience handbook used for evaluation of the sample ADPS was based on a sample of 18 existing Air Force ADP Systems. The conclusion of the evaluation is that the proposal should be returned for further study and analysis of certain aspects.

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I. INTRODUCTION

This primer is intended to clarify the use of the Air Force ADP Experience Handbook (Pilot Version) in the evaluation of ADPS proposals. It is specifically directed to users of the Air Force ADP Experience Handbook (Pilot Version). The Air Force ADP Experience Handbook (Pilot Version) will be used primarily by people assessing the concept of using highly structured ADP experience data for ADPS proposal evaluations. The pilot version of the handbook contains data collected after the fact from only 18 ADP systems, and hence the handbook has limited usefulness for actual evaluation of ADPS proposals. It does, however, contain cost estimation equations and narrative experience that will be useful until the 200-system handbook can be produced in Phase III.

This primer clarifies the handbook use through example. A hypothetical ADPS proposal is first presented, and this sample proposal is then evaluated using the experience handbook.

Section II is the ADPS proposal submission instruction advanced as an improved format for the Air Force. This format was used as a standard for preparation of the sample proposal in Section III. The proposal in Section III, although hypothetical in content, does have a high degree of correspondence with existing Air Force systems and procedures. The sample proposal is for a Major Air Command Centralized Military Pay System (MAC CMPS). Section IV is the evaluation of the proposed MAC CMPS using the experience handbook. The evaluation in Section IV includes the detailed mechanical procedures to be followed for cost estimating and experience data retrieval, as well as the conclusions and recommendations based on the retrieved experience.

II. ADPS PROPOSAL SUBMISSION INSTRUCTION

Complete detail pertaining to each ADPS proposal item should be furnished if possible. If certain items are not available at time of submission, it should be so stated. Items not directly pertinent to the specific proposal should be marked "Not Applicable." The following format must be followed:

A. Identification

Indicate originating base and/or organization, parent command, and preparation date.

B. Title

State the name of the proposed system. Identify the data automation requirement/recommendation.

C. Purpose

State the purpose of the proposed automation and specify what is to be accomplished. Relate this to an established function or responsibility. Give any background information that will lead to better understanding of the requirement and the proposed solution. Indicate any associated organizational and procedural changes contemplated.

D. System Summary

Fill out the "System Summary" form (shown on the following page) using entries consistent with indexing classifications found in the ADP Experience Handbook (Pilot Version).

E. System or Modification Description

1. Inputs

Describe the content, the purpose, and (where possible) the format of each major input to the system. Describe the source for inputs, communications required for the inputs, and type of input validation.

2. Data Base

Describe the content, the purpose, and (where possible) the format of each major file in the system. Stress update procedures and the use of the files in the operation of the system.

3. Outputs

Describe the content, the purpose, and (where possible) the format of each major output from the system. Describe the user of outputs and communications required to get outputs to the user.

4. Data Flow

By flow charts and/or narrative means, describe the major functions of the system. Show the data flow and indicate the system's relationship with the users and with other systems.

5. Workload Descriptors

Explain the derivation of the following workload descriptors:

a. Number of Input Transaction Types

b. Number of Input Data Fields

c. Number of Output Formats

d. Number of Data Base Record Types

e. Characters Per Month Input Volume

f. Characters Per Month Output Volume

g. Characters in Data Base

6. Functional Area

Indicate which of the following functional areas are involved:

Code	Functional Use
A	Operations Supporting Systems
B	Research and Development Systems
C	Equipment Management Systems
D	Material Management Systems
E	Personnel/Manpower Systems
F	Civil Engineering Management Systems
G	Maintenance Management Systems
H	Financial and Accounting Operations Systems
I	Medical Operations Systems
J	Procurement and Production Management Systems
K	Plans and Programs
L	Weather Systems
M	Communications Management Systems
N	Intelligence Systems
O	Transportation Management Systems
P	Miscellaneous

D. System Summary for _____
(System Title)

1. System or Modification Description
   a. Inputs (Briefly describe major inputs)

   b. Data Base (Briefly describe major files)

   c. Outputs (Briefly describe major outputs)

   d. Data Flow (Briefly describe major processing)

   e. Workload Descriptors
      1. Number of Input Transaction Types
      2. Number of Input Data Fields
      3. Number of Output Formats
      4. Number of Data Base Record Types
      5. Characters Per Month of Input Volume
      6. Characters Per Month of Output Volume
      7. Characters in Data Base

   f. Functional Area Designation

   g. Decentralized Operations (number of operational sites)

   h. Multiple Applications (number of applications on equipment)

   i. Programming Language(s)

   j. Type of Processing

   k. File Conversion

   l. Direct Access Storage (number of characters on D/A)

2. Development Plan
   a. Months of Elapsed Development Time
   b. (Indicate key milestones and major tasks to be accomplished)

3. Resource Requirements
   a. Cost Factors: (These values should reflect one operational site and should include existing as well as additional resources.)
      1. Man-Months of Development Effort
      2. Dollars of Hardware Cost for Program Checkout
      3. Dollars Per Month of Hardware Cost for Application Production
      4. Dollars Per Month of Hardware Cost for Program Maintenance
      5. Number of Operations Personnel
      6. Number of Program Maintenance Personnel
   b. Hardware (Indicate types of equipment and approximate dollar cost)

4. Benefits Analysis (Briefly indicate economic and/or other benefits to accrue through the proposed system or modification.)

7. Decentralized Operations

Explain where the system is to be operational, the number of sites, their relationships, and provisions for software maintenance and control.

8. Multiple Applications

State if the system shares hardware with other applications.

9. Programming Languages

Explain the programming languages and system support programs to be utilized.

10. Type of Processing

Explain the mode of operation, especially if on-line, time-sharing, etc.

11. File Conversions

Explain any file conversion requirements. If possible, explain the size and nature of the files and the methods to be used to accomplish the conversions.

12. Direct Access Storage

Indicate disk or any other special direct access storage devices required. Include size and timing requirements.

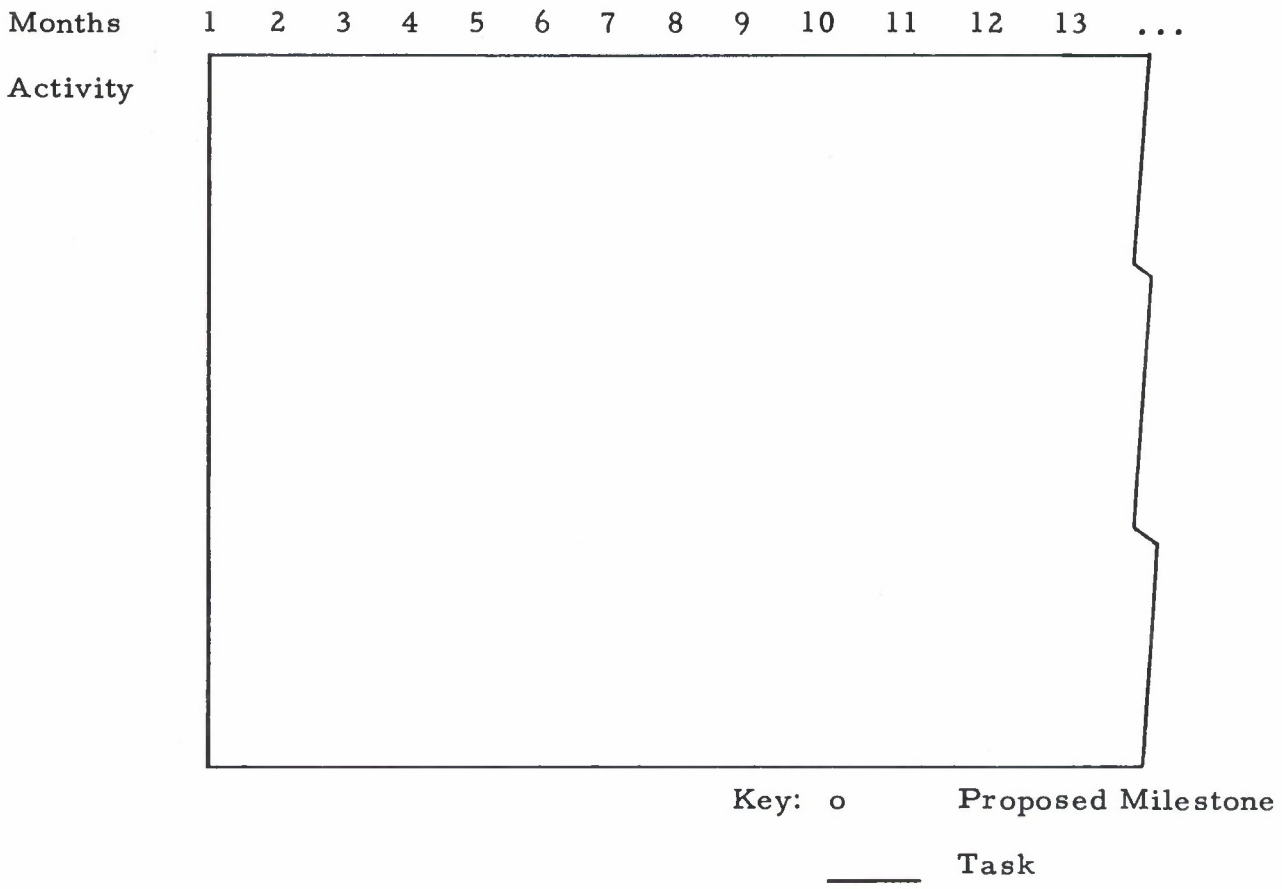
13. Growth Potential

Estimate the growth rate of the system, especially as it affects new software or hardware requirements in the future. If possible, estimate the workload that the system could handle without further modification.

F. Development Plan

Using the following chart, show the planned schedule for the development/modification proposed:

DEVELOPMENT SCHEDULE



Indicate key milestones, such as specifications complete, programming started/completed, hardware delivered, hardware checkout complete, program checkout complete, testing, system operational, etc. Prepare a task list defining all major tasks to be performed and indicate these in the appropriate place on the development plan chart. Discuss any anticipated schedule problems and their proposed solutions.

G. Resource Requirements

Indicate, to the degree possible, the anticipated resources required for the proposed system or modification. Also, identify those resources which are additional over those now in use. Resource requirements should be specified as being command or Air Force-wide, separately identified within the following groups:

1. Manpower

Categories to be identified include:

a. Development (man-months or man-years by rank/grade)

- o Systems analysis
- o Programming, checkout
- o File conversion

b. Operations (number by rank/grade)

- o Operators
- o Maintenance programmers

2. Hardware

Identify types of hardware with approximate dollar costs. Include the following itemization:

a. Development

- o Hours for checkout and test

b. Operations

- o Hours per month for production
- o Hours per month for program maintenance

3. Physical Facilities (site preparation, approximate dollar cost).

4. Communications (identify number of units, approximate dollar cost).

5. Other (as appropriate).

H. Benefits Analysis

Indicate the economies and other benefits to accrue through the proposed system or modification. Tangible benefits (personnel, equipment, or other savings) should be summarized to indicate an estimated dollar value for a specific time period. Intangible benefits (increased efficiency or responsiveness, accomplishment of tasks not previously feasible or possible, preclusion of increased cost of current operations, etc.) should be outlined in narrative form, with explanation or derivation of the benefit.

Indicate the benefits of alternative approaches compared with the proposed system. Compare workload capacity and growth potential of

the alternative systems. Indicate the results of analyses conducted on possible computer/system sharing.

I. Remarks

Include additional information that would facilitate understanding and evaluation of this ADPS proposal.

III. SAMPLE ADPS PROPOSAL

A. Identification

Submitted by Air Force Accounting and Finance Center (AFAFC). Prepared 1 December 1966.

B. Title

Major Air Command Centralized Military Pay System (MAC CMPS). The submittal of this proposal complies with Department of Defense Directive 7040.3 for improvement in management of military personnel appropriations and related personnel programs of the armed forces.

C. Purpose

The MAC CMPS will provide an accurate and timely accounting, reporting, and distribution of Air Force military personnel pay. The system is to be operational at the following major air command headquarters: ADC, AFLC, AFSC, ATC, HEDCOM, MAC, PACAF, SAC, TAC, USAFE, and USAFSS. Each of these selected major air command headquarters will transmit (via AUTODIN) payroll and management reports to the bases of the command.

This system will replace the Accrued Military Pay System (AMPS). It will assume all the functions of AMPS, and, in addition, will produce certain management reports not possible with AMPS.

The Honeywell 800/200 computer configuration exists at 10 of the 11 proposed operational sites. The exception is Headquarters, AFLC, which has an IBM 7080/1401 computer configuration. The MAC CMPS will use this existing computer hardware for both development and operations. Based on analysis of RCS E-6 reports, there is sufficient idle time on each of the Honeywell 800/200 systems and the IBM 7080/1401 system at Headquarters, AFLC, to allow operation of this system without necessitating new hardware acquisition.

Note: This is a highly simplified proposal with hypothetical content. It is intended only to illustrate the recommended proposal format and to be a vehicle for learning how to use the Air Force ADP Experience Handbook (Pilot Version).

D. System Summary for Major Air Command Centralized Military Pay System
(System Title)

1. System or Modification Description

a. Inputs (Briefly describe major inputs)
Sorted MPR Input: This input contains data for updating the MPR File. The data are received from the bases of a MAC via AUTODIN.
Report Requests: This input is also received from the bases of a MAC via AUTODIN. These requests are used to generate summary reports.

b. Data Base (Briefly describe major files)
Military Pay Record (MPR) File: This file contains descriptive and military pay history for each individual being serviced by MAC CMPS.
Computational File: This file contains constants and basic algorithms for military pay calculations.

c. Outputs (Briefly describe major outputs)
Paychecks: Produced twice monthly and sent to bases via AUTODIN.
Summary Reports: Produced as required or requested. Included are Military Payroll Certification, Accrued Pay Report, MAFR Balance Proof, etc.

d. Data Flow (Briefly describe major processing)
Phase I - Input Edit: Input is edited, sorted, and report requests are selected.
Phase II - Payroll Computation and MPR File Update: Paychecks and required reports are produced.
Phase III - Report Generation: Requested reports are produced.
Phase IV - Quarterly MPR Report: Fiscal year to date military pay record report.

e. Workload Descriptors

1.	Number of Input Transaction Types	15
2.	Number of Input Data Fields	133
3.	Number of Output Formats	19
4.	Number of Data Base Record Types	6
5.	Characters Per Month of Input Volume	10,780,000
6.	Characters Per Month of Output Volume	35,500,000
7.	Characters in Data Base	20,570,000

f. Functional Area Designation: Financial & Accounting Operations

g. Decentralized Operations (number of operational sites): 11

h. Multiple Applications (number of applications on equipment): greater than 10

i. Programming Language(s): COBOL; ARGUS & Autocoder

j. Type of Processing: Batched under executive control

k. File Conversion: From ADP System to ADP System

l. Direct Access Storage (number of characters on D/A): 0

2. Development Plan

a. Months of Elapsed Development Time: 11

b. (Indicate key milestones and major tasks to be accomplished)

Expected duration of system specifications development: 3 months
Expected duration of program specifications development: 2 months
Expected duration of programming: 6 months
Expected duration of program testing: 5 months
Expected duration of system testing: 2 months
Full operational capability expected: 7 months after initial operational capability or 18 months from start of development

3. Resource Requirements

a. Cost Factors: (These values should reflect one operational site and should include existing as well as additional resources.)

1.	Man-Months of Development Effort	290
2.	Dollars of Hardware Cost for Program Checkout	75,800
3.	Dollars Per Month of Hardware Cost for Application Production	4,900
4.	Dollars Per Month of Hardware Cost for Program Maintenance	39?
5.	Number of Operations Personnel	5
6.	Number of Program Maintenance Personnel	4

b. Hardware

(Indicate types of equipment and approximate dollar cost)
Existing hardware will be utilized by MAC CMPS.

4. Benefits Analysis

(Briefly indicate economic and/or other benefits to accrue through the proposed system or modification.)

Reduction of 400 base personnel currently operating AMPS, saving $2 million per year. Elimination of NCR 390 computers saving $4.3 million per year with additional H800/200 and IBM 7080/1401 and PCAM costing $3 million per year, resulting in a net saving of $3.3 million.

Note: This is a highly simplified proposal with hypothetical content. It is intended only to illustrate the recommended proposal format and to be a vehicle for learning how to use the Air Force ADP Experience Handbook (Pilot Version).

E. System Description

1. Inputs

a. Sorted MPR Input

Data for updating the MPR file are received from the bases via AUTODIN. The data are edited and sorted by base identification (major sequence), AFSN (intermediate sequence), and input type code (minor sequence). This Sorted MPR input File includes the following input transactions: promotions, transfers, flight pay authorizations, change in dependents, Basic Allowance for Quarters (BAQ) change, etc.

b. Report Requests

These files are decks of BCD cards coming from the base AFO's, MAC Headquarters, or AFAFC via AUTODIN. The cards report code (minor sequence). This is the means whereby specially requested management reports are generated.

2. Data Base

a. Military Pay Record (MPR) File

This file is maintained on magnetic tape. The file is in sequence by base identification (major sequence) and by Air Force Service Number (AFSN) (minor sequence). The file has two types of records. The first is a header record containing alphanumeric descriptive data on the individual. The second is a pay period data record, also alphanumeric.

b. Computational File

This file, which is maintained on magnetic tape, has several types of records. The initial record contains constants and basic algorithms (coding) that are susceptible to change, such as current pay rates, Federal Income Tax Withheld (FITW) calculation algorithm, Federal Insurance Contributions Act (FICA) calculation algorithm, FICA maximum, etc. This record is read into the computer and is necessary for all computational operations in this system. The other records of this file contain summary information on accruals and liabilities up to the last payroll, which is cataloged in several ways to assist in efficient information retrieval.

Note: This is a highly simplified proposal with hypothetical content. It is intended only to illustrate the recommended proposal format and to be a vehicle for learning how to use the Air Force ADP Experience Handbook (Pilot Version).

3. Outputs

The following are typical of MAC CMPS output products:

- o Military Payroll Certification: Includes EOM Voucher, Transfer Out Payment, Midmonth Pay, Discharge Payments, etc.
- o Paychecks: Generated twice monthly at the bases from data received from MAC headquarters via AUTODIN
- o Accrual Pay Report and MAFR Balance Proof: Verifies current, first prior, and second prior fiscal year amounts reported to the Report of Accrual Obligations for Military Pay (RAOMP)

4. Data Flow

The data flow of the major portions of the system is illustrated by Exhibit 1.

5. Workload Descriptors

The workload descriptors of MAC CMPS are summarized in Exhibit 2. The following is a detailed explanation of how these values were computed.

a. Number of Input Transaction Types--15

Included are existing AMPS input transaction types such as MPR opening header (AF Form 1926), MPR opening data (AF Form 1927), pay computation exception (AF Form 1930), etc., and newly designed input transaction types required by the MAC concept of processing military pay.

b. Number of Input Data Fields--133

All input transactions have three common fields: (1) base identification, (2) AFSN, and (3) input type code. The number of data fields per input type ranges from a minimum of 4 to a maximum of 32.

Note: This is a highly simplified proposal with hypothetical content. It is intended only to illustrate the recommended proposal format and to be a vehicle for learning how to use the Air Force ADP Experience Handbook (Pilot Version).

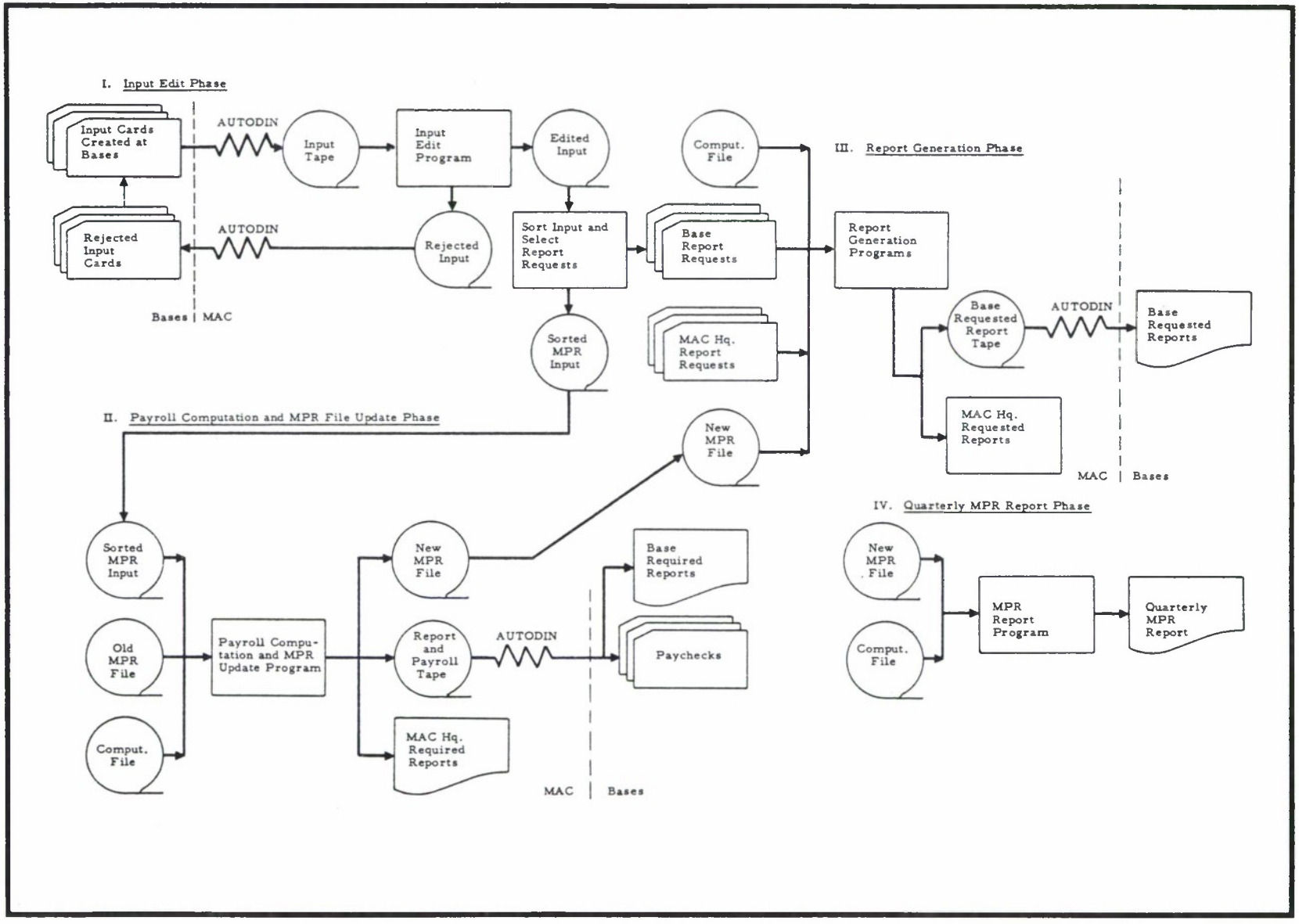


EXHIBIT 1 - MACROSYSTEM FLOW CHART

EXHIBIT 2 - PROPOSED VALUES OF WORKLOAD DESCRIPTORS

Workload Descriptor	MPR Input	Request Input	MPR File	Computational File	Paycheck Output	Reports	Total
Number of Input Transaction Types	15	2					15
Number of Input Data Fields	118	15					133
Number of Output Formats					1	18	19
Number of Data Base Record Types			2	4			6
Characters Per Month Input Volume	10,780,000	1,680					10,780,000
Characters Per Month Output Volume					7,700,000	27,800,000	35,500,000
Characters in Data Base			20,560,000	10,000			20,570,000

Note: This is a highly simplified proposal with hypothetical content. It is intended only to illustrate the recommended proposal format and to be a vehicle for learning how to use the Air Force ADP Experience Handbook (Pilot Version).

c. Number of Output Formats--19

Included are existing AMPS output formats such as military payroll certification (AF Form 163), paychecks, accrued pay report, and Merged Accountability and Fund Reporting (MAFR) balance proof, Report of Accrued Obligations for Military Pay (RAOMP), batch control and output totals (AF Form 1935), etc., and newly designed output formats made possible by the MAC concept of processing military pay.

d. Number of Data Base Record Types--6

The MPR file has two types of records: (1) the header record and (2) the pay period data record. The computational file has four types of records consisting of a constant and basic algorithms record and summary information records.

e. Characters Per Month of Input Volume--10,780,000

The input volume is dependent on the number of Air Force personnel to be paid. Assume the 11 MAC Headquarters, where this system will be operational, will process the entire Air Force military payroll for 850,000 personnel. Military personnel that are not in one of the 11 MAC's serviced by MAC CMPS will be serviced by the operational site closest to the base AFO or command headquarters of the personnel involved. The average MAC Headquarters servicing 12 AFB's each will process data for 850,000/11, or 77,000, Air Force personnel. It is estimated that 140 characters of MPR input per month per individual will be received. Requests for reports are expected to arrive at a rate of 3 requests per pay period per AFB and 6 requests per pay period per Headquarters, MAC, with each request containing 20 characters.

- Thus, the input volume is 77,000 personnel x 140 characters per month + 3 requests x 2 pay periods x 12 bases x 20 characters + 6 requests x 2 pay periods x 20 characters = approximately 10,780,000 characters per month.

f. Characters Per Month Output Volume--35,500,000

Output of this system is in the form of paychecks and various reports. A paycheck, containing 50 characters, is generated for each individual to be paid each bimonthly pay period. The required and requested reports are expected to contain approximately 7,270,000 characters per month. The quarterly MPR reports will average 800 characters per individual per quarter.

Note: This is a highly simplified proposal with hypothetical content. It is intended only to illustrate the recommended proposal format and to be a vehicle for learning how to use the Air Force ADP Experience Handbook (Pilot Version).

- Thus, the output volume is 77,000 personnel x 50 characters x 2 pay periods per month + 7,270,000 characters + 77,000 personnel x 800 characters 3 months per quarter = approximately 35,500,000 characters per month.

g. Characters in Data Base--20,570,000

The data base will be considered to be the contents of the MPR file and the computational file. The MPR file contains 200 characters of header information (see Exhibit 3) and 67 characters of pay period data per individual. The computational file contains about 10,000 characters, giving a total of about 20,570,000 characters in the data base.

6. Functional Area

This system is in category "H" (Financial and Accounting Operations Systems).

7. Decentralized Operations

The operation of the system will be decentralized as functionally equivalent systems at 11 locations. The system will be centrally controlled, probably by AFAFC, so as to ensure uniformity throughout the Air Force. In addition, the actual production of the physical paycheck is the responsibility of each base AFO.

8. Multiple Applications

This system will be just one of a number of applications on existing equipment at each MAC Headquarters. H800/200 MAC systems presently process more than 10 applications.

9. Programming Languages

All new programs for the H800 and IBM 7080 will be written in COBOL. This will result in lower programmer cost per instruction and will allow partial interchangeability of programs among the various machines involved: the H800, IBM 7080, and RCA 501. The assembly languages used will be ARGUS for the H200 and AUTOCODER for the IBM 4101.

10. Type of Processing

The type of processing for this system is expected to be batch processing under executive control.

Note: This is a highly simplified proposal with hypothetical content. It is intended only to illustrate the recommended proposal format and to be a vehicle for learning how to use the Air Force ADP Experience Handbook (Pilot Version).

EXHIBIT 3 - PROPOSED MPR HEADER FORMAT

No.	Name	Number of Characters
1	Base Identification	4
2	AFSN (Air Force service number)	8
3	Rank	2
4	Trans Code, Pay Month Code Pay, Met. Code--Branch of Service	23
5	Pay Option and Fly Pay	2
6	Number of Dependents	2
7	Tax Option or Chaplain	2
8	Basic Pay	5
9	Incentive Pay	5
10	Special or Foreign Duty Pay	5
11	Proficiency Pay	4
12	BAS (Basic Allowance for Subsistence)	5
13	BAQ (Basic Allowance for Quarters)	5
14	Clothing or Personal Money Allowance	4
15	Cost of Living Allowance	5
16	Housing Allowance	5
17	Total Temporary Entitlement	6
18	Total Temporary Deductions	6
19	Temporary FITW (Federal Income Tax Withheld)	5
20	Temporary FICA (Federal Insurance Contributions Act)	4
21	Temporary E, N, D, Q, B Allotments	6
22	Permanent FITW	5
23	Permanent FICA	4
24	Repayments	5
25	E Allotment	5
26	N, D, Q Allotments	5
27	B Allotments	5

Note: This is a highly simplified proposal with hypothetical content. It is intended only to illustrate the recommended proposal format and to be a vehicle for learning how to use the Air Force ADP Experience Handbook (Pilot Version).

EXHIBIT 3 (Continued)

No.	Name	Number of Characters
28	Miscellaneous Permanent Deduction	5
29	Clearing Account Hold	6
30	Clearing Account Other Debit	6
31	Clearing Account Other Credit	6
32	FITW Wages to Date	4
33	FICA Wages to Date	6
34	FITW Tax to Date	6
35	FICA Tax to Date	5
36	FICA Wages, This Quarter	6
37	Checksum	8
		200

Note: This is a highly simplified proposal with hypothetical content. It is intended only to illustrate the recommended proposal format and to be a vehicle for learning how to use the Air Force ADP Experience Handbook (Pilot Version).

11. File Conversion

All the files of this system must be created from scratch. Fortunately, the format of the MPR will be very similar to the Military Pay Record (magnetic strip) of the Accrued Military Pay System. The NCR 390's can be used to convert the existing files to punched cards, which can then be processed by MAC CMPS. Once the Update MPR File program is written, all new MPR File records can be considered as updates. Approximately 77,000 MPR's per MAC will be produced either during development or at the MAC's during the setup period.

12. Direct Access Storage

Not applicable.

13. Growth Potential

An increase in personnel would require more machine time for MAC CMPS interacting with possible increases in machine time requirements for other applications. Some MAC's will have overloaded computers. Workload could possibly be shifted from overloaded MAC's to MAC's where computer time is available to eliminate the need to add hardware.

F. Development Plan

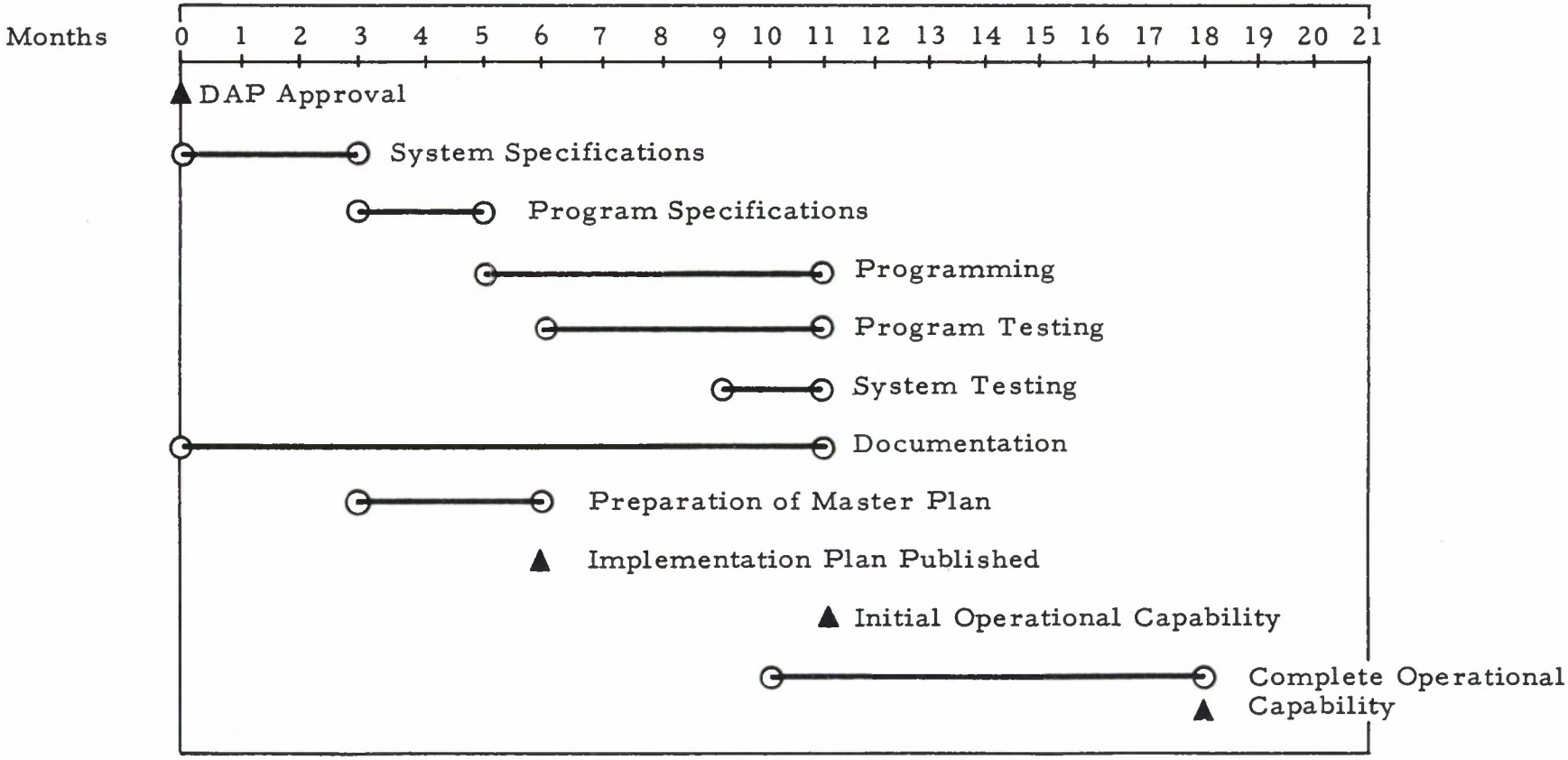
It is proposed that a System Development Project be established and that the Directorate of Military Pay be designated to direct the project. Data system analysis and design would be performed at the Air Force Accounting and Finance Center (AFAFC) and at Headquarters, ADC, where an H800 computer is available. System checkout will take place at a MAC headquarters with a sufficient excess of H800 computer time to accomplish the job with minimum interruption of other functions. It is suggested that this be at Headquarters, ADC, because of its proximity to AFAFC. Data System Specifications will be prepared and submitted to Headquarters, USAF, for review and approval, as shown in Exhibit 4, the overall schedule for development of the system.

G. Resource Requirements

The following is a list of the anticipated resource requirements both to develop and to operate the proposed system. See Exhibit 5 for a summary of these cost factors.

Note: This is a highly simplified proposal with hypothetical content. It is intended only to illustrate the recommended proposal format and to be a vehicle for learning how to use the Air Force ADP Experience Handbook (Pilot Version).

EXHIBIT 4 - PROPOSED DEVELOPMENT SCHEDULE



Note: This is a highly simplified proposal with hypothetical content. It is intended only to illustrate the recommended proposal format and to be a vehicle for learning how to use the Air Force ADP Experience Handbook (Pilot Version).

EXHIBIT 5 - ESTIMATED COST FACTORS OF MAC CMPS

1. Man-Months of Development Effort ------- 290

2. Months of Elapsed Development Time ------- 11 (initial capability)

   ------- 18 (fully operational)

3. Dollars of Hardware Cost for Program Checkout --- 75,800

4. Dollars per Month of Hardware Cost for Program Maintenance ------- 392

5. Dollars per Month of Hardware Cost for Application Production ---- 4,900 (at each MAC)

   ---- 53,900 (Air Force wide)

6. Number of Operations Personnel ---------- 5 (at each MAC)

   ------- 55 (Air Force wide)

7. Number of Program Maintenance Personnel ---- 4 (at AFAFC)

   ------- 2 (at each MAC)

   ------- 26 (Air Force wide)

Note: This is a highly simplified proposal with hypothetical content. It is intended only to illustrate the recommended proposal format and to be a vehicle for learning how to use the Air Force ADP Experience Handbook (Pilot Version).

1. Manpower

a. Development

o Systems analysis: Average of eight persons over the entire span of development (11 months). Level of experience should average that of Captain/GS-11, with at least 9 years' experience in ADP and 12 years' experience in military pay. AMPS currently has two analysts allocated to system maintenance at AFAFC.

o Programming and checkout: Average of 20 persons over the 7-month period. Level of experience should average that of 1st Lt./GS-9, with at least 5 years' experience in ADP. AMPS currently has 8 programmers allocated to program maintenance at AFAFC.

o File conversion: Three persons (one analyst and two programmers) to create the necessary programs and the MPR File and Computational File in order to check out the system at Headquarters, ADC. Each MAC will need two persons working with a clerk at each base to create the files necessary for implementation. This should take 2 to 3 months for each MAC.

b. Operations

Since the operation of the system will be just one addition to the other applications on existing equipment at the MAC's, the operation costs are relatively small.

o Operators: Five total operators at each MAC; four from existing resources. One additional.

o Maintenance programmers: An addition of two programmer/analysts at each MAC, and two analysts and two programmers from existing resources at AFAFC to maintain the system.

2. Hardware

This system will operate on existing hardware. The central computer will be the Honeywell 800 at all MAC's, except the IBM 7080 will be used at AFLC. The RCA 501 at AFAFC will be used only to check out COBOL programs.

Note: This is a highly simplified proposal with hypothetical content. It is intended only to illustrate the recommended proposal format and to be a vehicle for learning how to use the Air Force ADP Experience Handbook (Pilot Version).

a. Development

o Hours for checkout: It is estimated that 40 hours of RCA 501 time at AFAFC and 750 hours of Honeywell 800/200 time will be needed for development of the system. Approximately 20 hours of NCR 390 time will be necessary for file conversion at each MAC.

b. Operations

o Hours for production: Approximately 50 hours of Honeywell 800 or IBM 7080 time and 50 hours of Honeywell 200 or IBM 1401 time at each MAC to operate the system. This includes the update operations, the input edit, and the payroll computation itself.

o Hours for program maintenance: Approximately 3 hours/month at Headquarters, ADC, and 1 hour/month at each MAC.

c. Physical Facilities

The MAC CMPS will be operational on existing facilities.

d. Communications

The AUTODIN system will be used to receive inputs and to send system outputs. Approximately 20 million characters per major air command will be transmitted via AUTODIN each month.

H. Benefits Analysis

It is estimated that the Centralized Accrued Military Pay System will provide the following benefits:

- A manpower reduction of approximately 400 base personnel, currently operating AMPS, resulting in a saving of $2 million per year.
- Elimination of the NCR 390 systems with a saving of $4.3 million per year. Additional expenditures include additional rental hours of Honeywell 800 or IBM 7080 at the MAC Headquarters, costing $1.2 million per year; and communications and PCAM equipment at the bases, costing $1.8 million per year. This results in a net saving of $3.3 million per year.
- Provision of improved data handling methods for obligations accrued, making possible more frequent reconciliations of

Note: This is a highly simplified proposal with hypothetical content. It is intended only to illustrate the recommended proposal format and to be a vehicle for learning how to use the Air Force ADP Experience Handbook (Pilot Version).

deductions and those amounts paid by the Air Force. The net saving that this would cause is not known at this time.

- o Elimination of operational deficiencies imposed by memory limitations, slow operating speeds, and inflexibility to changing military pay requirements, existant on the present system.

The new system would supply some desired summary information and budget projections desired by management.

I. Remarks

None.

Note: This is a highly simplified proposal with hypothetical content. It is intended only to illustrate the recommended proposal format and to be a vehicle for learning how to use the Air Force ADP Experience Handbook (Pilot Version).

IV. SAMPLE ADPS PROPOSAL EVALUATION

The purpose of this section is to demonstrate the evaluation of the sample ADPS proposal from Section III using the Air Force ADP Experience Handbook (Pilot Version). Use of the handbook will follow the procedure outlined in the Use of the Experience Handbook section of the handbook. The evaluation of the sample ADPS proposal proceeds in the following steps:

1. Retrieval of cost estimates from cost estimation iso-graphs

2. Retrieval of relevant experience from system descriptions

3. Evaluation of the proposed ADPS with data retrieved in (1) and (2)

A. Retrieval of Cost Estimates

Cost estimates are retrieved from the cost estimation iso-graphs presented in Section II of the Air Force ADP Experience Handbook (Pilot Version). The procedure outlined in subsection I.A of the Air Force ADP Experience Handbook should be followed in using the cost estimation iso-graphs. Cost estimates are made for the following cost factors:

- Man-months of development effort
- Number of program maintenance personnel
- Number of operations personnel
- Dollars per month of hardware cost for application production
- Dollars per month of hardware cost for program maintenance

To make cost estimates and subsequent comparison of cost estimates to proposed costs, values are entered in the right hand column of the top three rows of Tables 1 through 5. These values of workload descriptors and proposed cost factors are all found in subsection III.D, System Summary.

The cost estimation iso-graph for number of program maintenance personnel is now entered with the value of number of input data fields (133) and number of output formats (19) from Table 2, to obtain the three values of number of program maintenance personnel that are entered in the bottom three rows of Table 2. Figure 1 illustrates the use of the cost estimation iso-graph for number of program maintenance personnel.

TABLE 1 - COST ESTIMATE OF MAN-MONTHS OF DEVELOPMENT EFFORT

Source	Description	Value
Obtained from System Summary Section of Proposal	Number of input data fields (variable to be entered on horizontal scale of iso-graph)	133
	Number of output formats (variable to be entered on vertical scale of iso-graph)	19
	Man-months of development effort (proposed cost to be compared with estimates below)	290
Determined from Cost Estimation Iso-Graph	The value man-months of development effort is expected to be less than, 90 percent of the time	880
	The value man-months of development effort is expected to be	235
	The value man-months of development effort is expected to be greater than, 90 percent of the time	63

TABLE 2 - COST ESTIMATE OF NUMBER OF PROGRAM MAINTENANCE PERSONNEL

Source	Description	Value
Obtained from System Summary Section of Proposal	Number of input data fields (variable to be entered on horizontal scale of iso-graph)	133
	Number of output formats (variable to be entered on vertical scale of iso-graph)	19
	Number of program maintenance personnel (proposed cost to be compared with estimates below)	4
Determined from Cost Estimation Iso-Graph	The value number of program maintenance personnel is expected to be less than, 90 percent of the time	16.5
	The value number of program maintenance personnel is expected to be	4.5
	The value number of program maintenance personnel is expected to be greater than, 90 percent of the time	1.2

TABLE 3 - COST ESTIMATE OF NUMBER OF OPERATIONS PERSONNEL

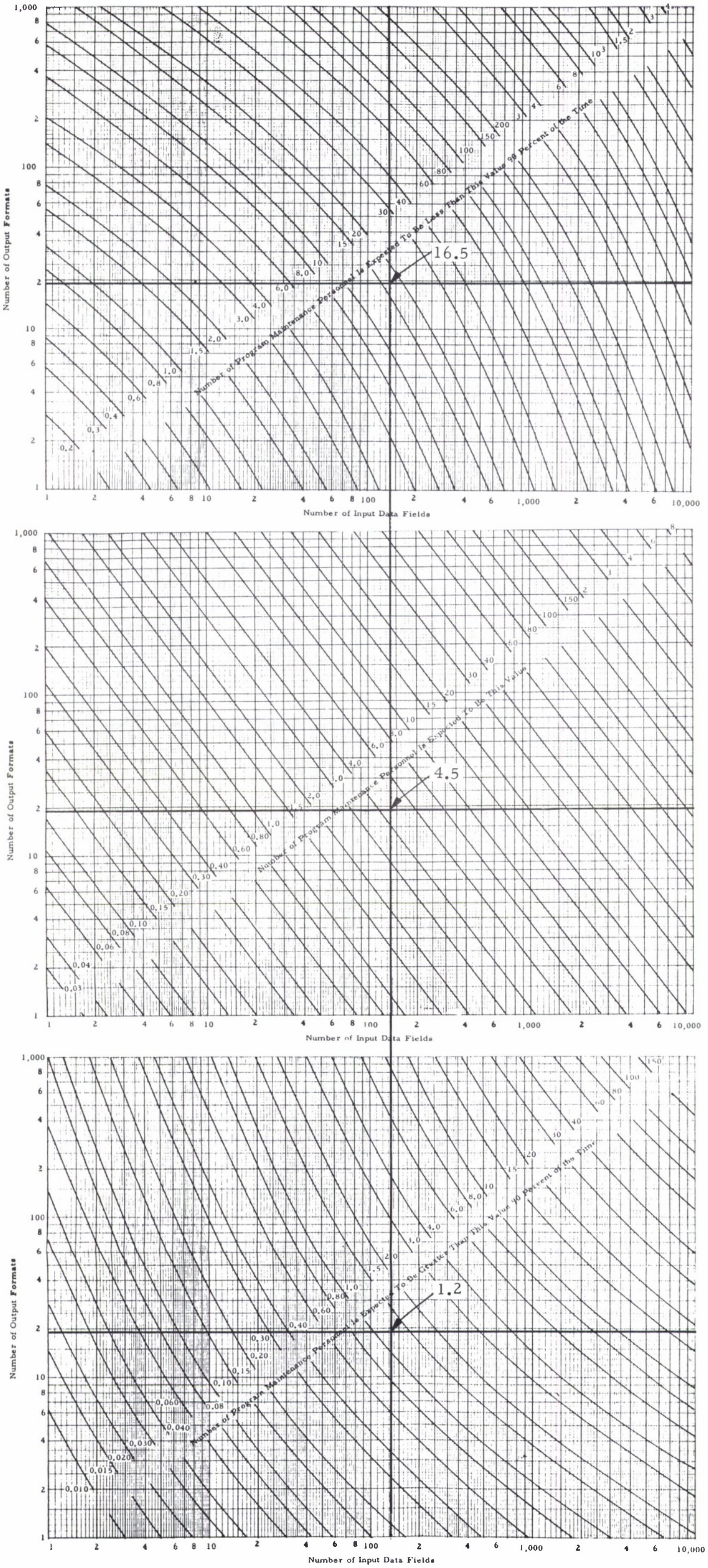
Source	Description	Value
Obtained from System Summary Section of Proposal	Characters in data base (variable to be entered on horizontal scale of iso-graph)	20,570,000
	Number of output formats (variable to be entered on vertical scale of iso-graph)	19
	Number of operations personnel (proposed cost to be compared with estimates below)	5
Determined from Cost Estimation Iso-Graphs	The value number of operations personnel is expected to be less than, 90 percent of the time	23
	The value number of operations personnel is expected to be	5.2
	The value number of operations personnel is expected to be greater than, 90 percent of the time	1.2

TABLE 4 - COST ESTIMATE OF DOLLARS PER MONTH OF HARDWARE COST FOR APPLICATION PRODUCTION

Source	Description	Value
Obtained from System Summary Section of Proposal	Characters per month of input volume (variable to be entered on horizontal scale of iso-graph)	10,780,000
	Number of output formats (variable to be entered on vertical scale of iso-graph)	19
	Dollars per month of hardware cost for application production (proposed cost to be compared with estimates below)	$ 4,900
Determined from Cost Estimation Iso-Graph	The value dollars per month of hardware cost for application production is expected to be less than, 90 percent of the time	$31,000
	The value dollars per month of hardware cost for application production is expected to be	$ 7,100
	The value dollars per month of hardware cost for application production is expected to be greater than, 90 percent of the time	$ 1,700

TABLE 5 - COST ESTIMATE OF DOLLARS PER MONTH OF HARDWARE COST FOR PROGRAM MAINTENANCE

Source	Description	Value
Obtained from System Summary Section of Proposal	Characters per month of input volume (variable to be entered on horizontal scale of iso-graph)	10,780,000
	Number of output formats (variable to be entered on vertical scale of iso-graph)	19
	Dollars per month of hardware cost for program maintenance (proposed cost to be compared with estimates below)	$392
Determined from Cost Estimation Iso-Graph	The value dollars per month of hardware cost for program maintenance is expected to be less than, 90 percent of the time	$11,700
	The value dollars per month of hardware cost for program maintenance is expected to be	$370
	The value dollars per month of hardware cost for program maintenance is expected to be greater than, 90 percent of the time	$12



Cost Estimating Procedure for Number of Program Maintenance Personnel

1. Find the value of Number of Input Data Fields for the proposed ADPS on the horizontal scale of any one of the three iso-graphs.
2. Draw a vertical line through all three iso-graphs at the value established in Step 1.
3. Find the value of Number of Output Formats for the proposed ADPS on the vertical scale of each of the three iso-graphs.
4. Draw a horizontal line on all three iso-graphs through the values established in Step 3.
5. On the top iso-graph, determine the value that Number of Program Maintenance Personnel is expected to be less than, 90 percent of the time, by logarithmically interpolating the intersection point of the vertical (Step 2) and horizontal (Step 4) lines between adjacent iso-lines.
6. On the center iso-graph, determine the value that Number of Program Maintenance Personnel is expected to be, by logarithmically interpolating the intersection point of the vertical (Step 2) and horizontal (Step 4) lines between adjacent iso-lines.
7. On the bottom iso-graph, determine the value that Number of Program Maintenance Personnel is expected to be greater than,90 percent of the time, by logarithmically interpolating the intersection point of the vertical (Step 2) and horizontal (Step 4) lines between adjacent iso-lines.

FIGURE 1 - EXAMPLE OF COST ESTIMATION ISO-GRAPHS FOR NUMBER OF PROGRAM MAINTENANCE PERSONNEL

A similar process is repeated for the other cost factors and entries are made in Tables 1, 3, 4 and 5.

Note that each proposed cost factor (third row of the tables) is between the value the cost factor is expected to be less than, 90 percent of the time (fourth row of the tables), and the value the cost factor is expected to be greater than 90 percent of the time (sixth row of the tables). It should also be noted that the proposed cost factors are reasonably close to the expected values of cost. The percentage deviation of a proposed cost from the expected cost is given by:

$$\text{Percent Deviation of Cost} = \frac{|\text{Proposed Cost} - \text{Expected Cost}|}{\text{Expected Cost}}$$

The deviation of the cost factors for the sample proposed ADPS are as follows:

Cost Factor	Deviation of Proposed Cost From Expected Cost
Man-months of development effort	23 percent
Number of program maintenance personnel	11 percent
Number of operations personnel	4 percent
Dollars/month of hardware cost for application production	31 percent
Dollars/month of hardware cost for program maintenance	6 percent

Subsection IV.C.1 is directed toward further analysis of cost factors, with relevant data retrieved from system descriptions.

B. Retrieval of Relevant Experience From System Descriptions

Relevant experience is retrieved from Section III, System Descriptions, of the Air Force ADP Experience Handbook (Pilot Version) through 12 indexes given in Section V of the handbook. Retreived data are collected into tables oriented toward questions and problem areas that interest the proposal evaluator. The retrieved experience data tables are presented at the end of this section. They are as follows:

1. Cost factors (Table 6)
2. Schedule (Table 7)
3. Benefits (Table 8)
4. Organization (Table 9)

5. Personnel (Table 10)

6. Hardware (Table 11)

7. Software (Table 12)

8. Application program development (Table 13)

9. File conversion (Table 14)

10. Documentation (Table 15)

11. Operations (Table 16)

12. Application program maintenance (Table 17)

An index only retrieves experience data from certain system description sections. The system description sections containing relevant data for a given index are specified in Figure 1 of the handbook. Experience data from system description sections is entered into the retrieved experience data table of the same name, when it exists. When no retrieved experience data with the section name exists, the experience data are placed in a retrieved experience data table with a related name.

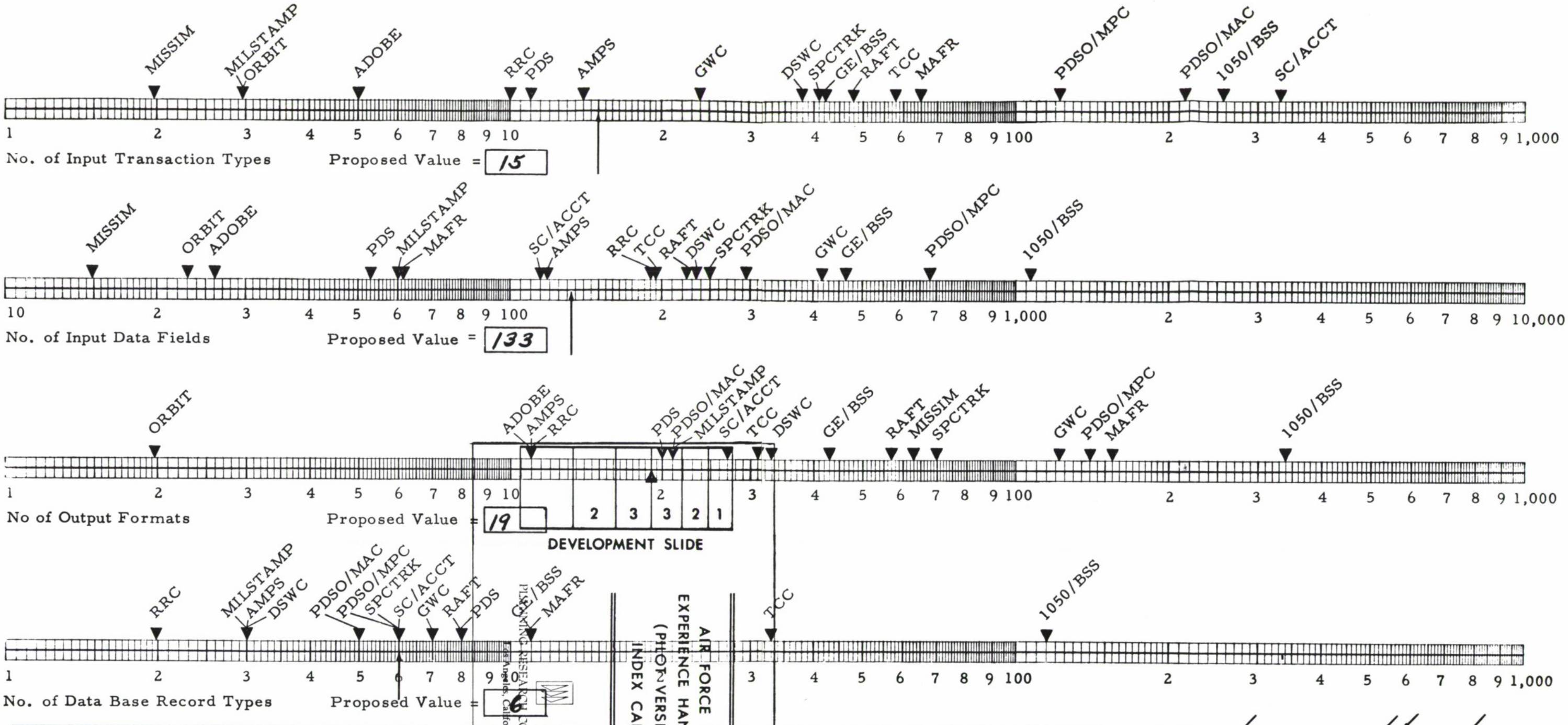
1. Retrieval with Development Experience Index

From the system summary (see subsection III.D), one determines the following values of workload descriptors used in the Development Experience Index:

Workload Descriptor	Value
Number of input transaction types	15
Number of input data fields	133
Number of output formats	19
Number of data base record types	6

These workload descriptors are entered in the boxes provided on the worksheet for Development Experience Index (reproduced as an example in Figure 2), and the procedure on the worksheet for determining relevant systems is followed. The ranking table on the worksheet identifies the following systems:

Highly Relevant	Relevant
AMPS	PDS
SC/ACCT	PDSO/MAC



Use of the Development Experience Index

The development experience index is used to retrieve relevant development experience from the system descriptions. Retrieval is based on the following workload descriptors:

- Number of Input Transaction Types
- Number of Input Data Fields
- Number of Output Formats
- Number of Data Base Record Types

Proposed values of these workload descriptors must be known for the ADPS under evaluation. The type of development experience and problems retrieved by this index will be related to the magnitude of the development effort. Sections of system descriptions which will be of greatest interest include:

- Application Program Development
- Application Program Maintenance
- **Schedule**

Other sections of interest include:

- Organization
- History
- Software
- File Conversion
- Documentation
- Personnel
- Benefits
- Cost Factors
- **Description**

Procedure

1. Enter the proposed values for No. of Input Transaction Types, No. of Input Data Fields, No. of Output Formats, and No. of Data Base Record Types in box below the corresponding scale.
2. Remove the index card from the pocket in the Air Force ADP Experience Handbook (Pilot Version) and position the center arrow of the Development Slide at the proposed value on the No. of Input Transaction Types scale.
3. For all systems bounded by the Development Slide, enter the number from the tolerance band in the No. of Input Transaction Types row of the Ranking Table beneath the corresponding system name.
4. Repeat steps 2 and 3 for No. of Input Data Fields, and No. of Output Formats.
5. Repeat steps 2 and 3 for No. of Data Base Record Types if the proposed value is not zero. If the proposed No. of Data Base Record Types is zero, enter the number 3 in the Data Base row of the Ranking Table beneath ADOBE, MISSIM, and ORBIT.
6. Enter the Total Rank in the bottom row of the Ranking Table. Total Rank is computed by adding the numeric entries in each each column of the Ranking Table.
7. The system with the largest Total Rank is the most relevant system in developmental aspects to the proposed system. Relevancy of other systems is in order of Total Rank. Systems with Total Rank equal to or greater than 7 are highly relevant to the proposed automation. Systems with Total Rank less than 7 but greater than 3 have less relevance, but may still be used, while developmental experience data from systems with Total Rank less than or equal to 3 should not be used.

Ranking Table

Page No.	39	46	53	60	67	74	81	88	95	102	109	116	123	130	137	144	151	158
	ADOBE	AMPS	DSWC	GE/BSS	GWC	MAFR	MILSTAMP	MISSIM	ORBIT	PDS	PDSO/MAC	PDSO/MPC	RAFT	RRC	SC/ACCT	SPCTRK	TCC	1050/BSS
No. of Input Trans. Type Rank		3								2				1				
No. of Input Data Fields Rank		3												1	3			
No. of Output Formats Rank	1	1					3			3	3			1	1			
No. of Data Base Record Types Rank					2					1	2	3	1		3	3		
Total Rank	1	(7)			2		3			(6)	(5)	3	1	3	(7)	3		

FIGURE 2 - WORKSHEET FOR DEVELOPMENT EXPERIENCE INDEX

Experience data are retrieved from system description sections as indicated in Figure 1 of the handbook. The retrieved experience data are then recorded in the retrieved experience data tables (Tables 6 through 17).

2. Retrieval with Operations Experience Index

From the system summary (see III.D) one determines the following values of workload descriptors used in the Operations Experience Index:

Workload Descriptor	Value
Characters/month of input volume	10,780,000
Characters/month of output volume	35,500,000
Characters in data base	20,570,000

These workload descriptors are entered in the boxes provided on the worksheet for Operations Experience Index (reproduced as an example in Figure 3), and the procedure on the worksheet for determining relevant systems is followed. The ranking table on the worksheet identifies the following systems:

Highly Relevant	Relevant
RAFT	PDSO/MAC
	GE/BSS

Experience data are retrieved from system description sections as indicated in Figure 1 of the handbook. The retrieved experience data are then recorded in the retrieved experience data tables (Tables 6 through 17).

3. Retrieval With Functional Area Index

From the system summary (see subsection III.D) one determines that the functional area of the proposed system is financial and accounting. Using a functional area of financial and accounting and following instructions in subsection I.B.3 of the handbook, the following systems are selected as relevant:

AMPS
MAFR
RAFT
SC/ACCT

Experience data are retrieved from system description sections as indicated in Figure 1 of the handbook. The retrieved experience data are then recorded in the retrieved experience data tables (Tables 6 through 17).

4. Retrieval With Decentralized Operations Index

From the system summary (see subsection III.D) one determines that the proposed number of operational installations is 11. Using a number of operational installations of 11, and following the instructions from subsection I.B.4 of the handbook, the following systems are selected as relevant:

DSWC
PDSO/MAC
SC/ACCT

Experience data are retrieved from system description sections as indicated in Figure 1 of the handbook. The retrieved experience data are then recorded in the retrieved experience data tables (Tables 6 through 17).

5. Retrieval With Multiple Application Index

From the system summary (see subsection III.D) one determines that more than 10 applications will be operating at an installation. Using more than 10 applications at an installation, and following the instructions from subsection I.B.5 of the handbook, the following systems are selected as relevant:

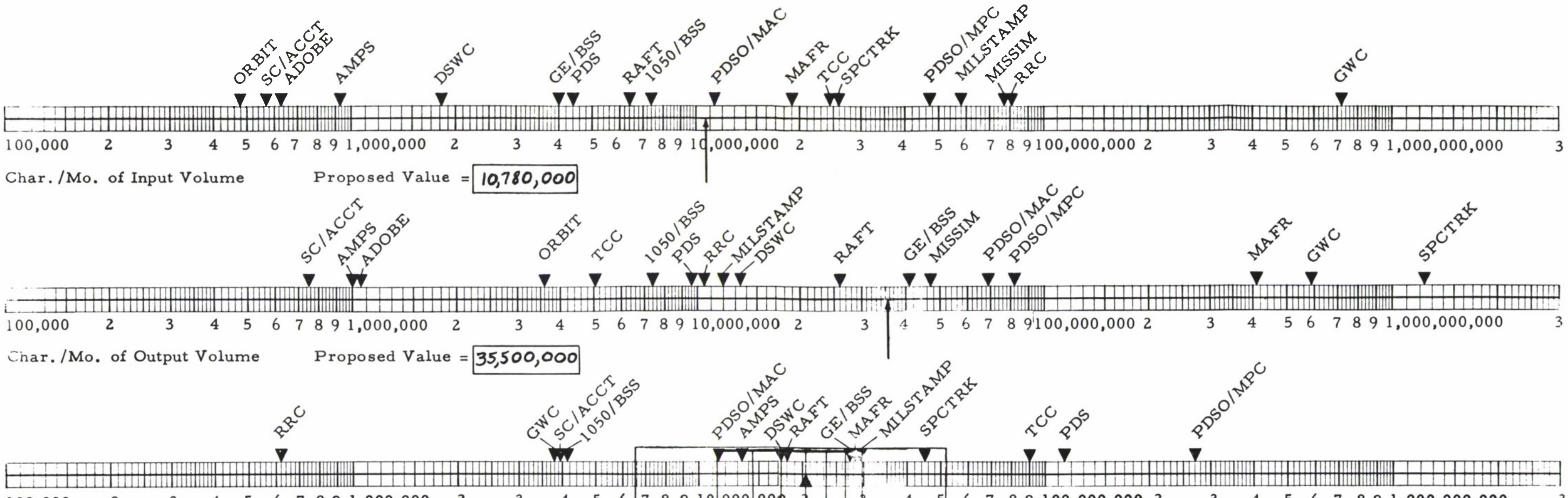
ADOBE
DSWC
MISSIM
ORBIT
PDSO/MAC
RRC
SC/ACCT

Experience data are retrieved from system description sections as indicated in Figure 1 of the handbook. The retrieved experience data are then recorded in the retrieved experience data tables (Tables 6 through 17).

6. Programming Language Index

From the system summary (see subsection III.D) one determines that the following programming languages are proposed for MAC CMPS: COBOL, ARGUS, and AUTOCODER. Each of these languages is looked up in the Programming Language Index Table individually, using instructions from subsection I.B.6 of the handbook. The following systems were retrieved as relevant to COBOL:

MAFR
MILSTAMP
PDSO/MAC
RAFT



Use of the Operations Experience Index

The operations experience index is used to retrieve relevant operations experience from the system descriptions. Retrieval is based on the following workload descriptors:

Char./Mo. of Input Volume
Char./Mo. of Output Volume
Char. in Data Base

Proposed values of these workload descriptors must be known for the ADPS under evaluation. The type of operations experience and problems retrieved by this index will be related to the magnitude of the operations. Sections of the system descriptions which will be of greatest interest include:

Operations
Hardware

Other sections of interest include:

Organization	Documentation	Cost Factors
Software	Personnel	
File Conversion	Benefits	Description

Procedure

1. Enter the proposed values for Char./Mo. of Input Volume, Char./Mo. of Output Volume, and Char. in Data Base in the box below the corresponding scale.
2. Remove the index card from the pocket in the Air Force ADP Experience Handbook (Pilot Version) and position the center arrow of the Operations Slide to the proposed value of the Char./Mo of Input Volume scale.
3. For all systems bounded by the Operations Slide, enter the number from the tolerance band in the Char./Mo. of Input Volume row of the Ranking Table beneath the corresponding system name.
4. Repeat steps 2 and 3 for Char./Mo. of Output Volume.
5. Repeat steps 2 and 3 for Char. in Data Base if the proposed value is not zero. If the proposed Char. in Data Base is zero, enter the number 3 in the Data Base row of the Ranking Table beneath ADOBE, MISSIM, and ORBIT.
6. Enter the Total Rank in the bottom row of the Ranking Table. Total Rank is computed by adding the numeric entries in each column of the Ranking Table.
7. The system with the largest Total Rank is the most relevant system in operational aspects to the proposed system. Relevancy of other systems is in order of Total Rank. Systems with Total Rank equal to or greater than 5 are highly relevant to the proposed system. Systems with Total Rank less than 5 but greater than 2 have less relevance, but may still be used, while operational experience data from systems with Total Rank less than or equal to 2 should not be used.

Ranking Table

	ADOBE	AMPS	DSWC	GE/BSS	GWC	MAFR	MILSTAMP	MISSIM	ORBIT	PDS	PDSO/MAC	PDSO/MPC	RAFT	RRC	SC/ACCT	SPCTRK	TCC	1050/BSS
Page No.	39	46	53	60	67	74	81	88	95	102	109	116	123	130	137	144	151	158
Input Vol. Rank											3		1					1
Output Vol. Rank				3				1					2					
Data Base Size Rank		1	2	1		1	1				1		3					
Total Rank		1	2	(4)		1	1	1			(4)		(6)					1

FIGURE 3 - WORKSHEET FOR OPERATIONS EXPERIENCE INDEX

The following systems were retrieved as relevant to AUTOCODER:

DSWC
RRC
SC/ACCT
TCC

PDSO/MAC was retrieved as relevant to ARGUS. Experience data are retrieved from system description sections as indicated in Figure 1 of the handbook. The retrieved data are then recorded in the retrieved experience data tables (Tables 6 through 17).

7. Processing Type Index

From the system summary (see subsection III.D) one determines that the proposed processing type is batched under executive control. Using batched under executive control, and following the instructions from subsection I.B.7 of the handbook, the following systems are selected as most relevant because they use the same computer at 9 of the proposed 11 installations:

PDSO/MAC
DSWC

Experience data are retrieved from system description sections as indicated in Figure 1 of the handbook. The retrieved experience is then recorded in the retrieved experience data tables (Tables 6 through 17).

8. File Conversion Index

From the system summary (see subsection III.D) one determines that the file conversion was from one ADP System to another ADP System. Using the ADP-system-to-ADP-system type of file conversion, and following the instructions from subsection I.B.8 of the handbook, PDSO/MAC is selected as relevant because it uses the same hardware at 8 of the 11 proposed MAC CMPS operational sites and the MAC level of organization is the same. AMPS is also considered relevant because it will produce parts of the files necessary for MAC CMPS.

Experience data are retrieved from system description sections as indicated in Figure 1 of the handbook. The retrieved experience is then recorded in the retrieved experience data tables (Tables 6 through 17).

9. Direct Access Storage Index

The proposed ADPS does not use direct access storage; therefore, no relevant experience data may be obtained with this index.

10. Computer Cost Index

MAC CMPS will be checked out and operated on existing computers at all 11 proposed operational sites; hence there is no point in studying systems with computers of approximately the same cost.

11. Computer Index

The only system isolated with the H800/200 using this index was PDSO/MAC. Sufficient experience has already been retrieved from PDSO/MAC. The operational installation at AFLC will be on the IBM 7080/1401. This computer is operational at DSWC and RRC. Sufficient experience has already been retrieved from DSWC.

12. Security Index

No special security problems are anticipated with MAC CMPS.

C. Evaluation of Proposal With Retrieved Experience Data

1. Reasonableness of Proposed Costs

The cost estimation iso-graphs are used to provide three estimates (high, middle, low) for each cost factor. The cost factor is expected to be greater than the middle value 50 percent of the time and less than the middle value 50 percent of the time. The high and low values form a range that would include the real value of the cost factor 80 percent of the time. If the proposed cost falls outside the range, that cost factor should be carefully re-examined and possibly recosted by the proposer. If the proposed cost falls within the range, then retrieved data from relevant systems are evaluated to determine further the reasonableness of proposed costs.

Subsection IV.A indicates that all proposed costs fell in the range obtained from the iso-graphs. The subsequent sections, therefore, use retrieved relevant experience to investigate further the reasonableness of the proposed costs.

a. Man-Months of Development Effort

The immediate conclusion drawn from the number of man-months actually required for the four systems selected by the Development Experience Index is that the proposed 290 man-months may be low.

The Cost Factors Table (Table 6) relates that AMPS required 704 man-months, more than any of the other selected systems. The Application Program Development Table (Table 13) relates that the AMPS programs were written in absolute machine language and were directed to be operational in 2 years. The proposed system will be written in COBOL, which is not as time consuming as absolute machine language programming. The Personnel Table (Table 10) relates that AMPS used nearly three times the number of system analysts proposed for the MAC CMPS. This large number of AMPS system analysts was undoubtedly a factor in the large number of man-months required for development and was probably because of the fact that AMPS development was a manual to ADP system conversion (rather than an outgrowth of an earlier ADP system as the MAC CMPS will be).

PDSO/MAC development required fewer man-months than AMPS, 489. However, the Application Program Development Table (Table 13) relates that PDSO/MAC development required two activities that may have excessively increased the number of man-months required. The first activity was a redesign of some parts of the system caused by a decision that a variable-word-length computer would be used before the fixed-word-length H800 computer was selected. The second activity was reprogramming of some inquiry system programs in the ARGUS assembly language because they operated inefficiently in COBOL. The proposed system will be designed to operate on existing hardware, and there will be no inquiry system in the MAC CMPS.

The Cost Factors Table (Table 6) relates that the remaining two selected systems, PDS and SC/ACCT, required fewer man-months than the proposed 290. However, the Personnel Table (Table 10) relates that both of these systems used significantly fewer system analysts and programmers than the MAC CMPS. In addition, both systems were developed within a single major air command, whereas the MAC CMPS development will involve 11 major air commands.

It is reasonable to assume, then, that PDSO/MAC's number of man-months, decreased by the man-months expended for the previously mentioned redesign and reprogramming efforts, will most closely approximate what should be expended for the MAC CMPS. This is because of the many similarities between the two systems.

b. Number of Program Maintenance Personnel

The indication from the number of personnel actually required by the systems selected by the Development Experience Index is that the proposed four program maintenance personnel may be low.

The Cost Factors Table (Table 6) relates that the number of program maintenance personnel required is 9 for PDSO/MAC, 10 for AMPS, 7 for PDS, and 2 for SC/ACCT.

The Application Program Maintenance Table (Table 17) relates that 70 percent of the time devoted to AMPS program maintenance is for changes caused by legislative requirements. Since the MAC CMPS will replace AMPS, this cause of program maintenance effort is expected to continue.

The Application Program Maintenance Table (Table 17) also relates that a certain amount of PDSO/MAC program maintenance effort is involved in tailoring the basic PDSO/MAC system to operate on the H800/200 computers, which are differently configured from MAC to MAC. Also, program maintenance is caused by the development of command-unique "add-ons" to the basic system. The MAC CMPS may also be confronted with having to tailor the basic system, because it will use the same hardware as PDSO/MAC. It may also be advantageous to develop command-unique "add-ons" for efficiency within commands.

It is reasonable to assume, then, that the proposed number of program maintenance personnel, for MAC CMPS should be somewhat higher, probably 7 to 10. This reasoning is supported by the number of personnel required by the two closely related systems, AMPS and PDSO/MAC.

c. Number of Operations Personnel

Five operations personnel appears to be reasonable since this is supported by data retrieved from the three systems selected by the Operations Experience Index. The Cost Factors Table (Table 6) relates that the number of operations personnel required by GE/BSS, RAFT, and PDSO/MAC are eight, three, and seven, respectively.

PDSO/MAC should be given the most weight because it uses the same hardware as the MAC CMPS. The Operations Table (Table 16) relates that the MAC CMPS will use less computer time for application production. Thus, it can be assumed that the MAC CMPS will use fewer operations personnel than PDSO/MAC.

d. Dollars per Month of Hardware Cost for Application Production

The immediate conclusion drawn from the amounts actually spent by the three systems selected by the Operations Experience Index is that the proposed $4,900 is low.

The Cost Factors Table (Table 6) relates that GE/BSS is the only application on the GE 225 computer, and rental is by a basic monthly charge of $9,400 per computer regardless of the number of hours used. This cannot be compared with the dollar per hour rate used to obtain the proposed $4,900. Therefore, it should be disregarded.

PDSO/MAC, however, is charged by the hour. The Cost Factors Table (Table 6) relates that PDSO/MAC costs $10,457 per month for the H800 and H200 for both application production and program maintenance (done only at HQ ATC). The Operations Table (Table 16) relates that 89 hours were for application production on the H800 computer and 14 hours for program maintenance on the H800. Thus, 89 hours of application production alone cost approximately $9,060.

The proposed MAC CMPS estimates that 50 hours per month will be used for application production. It is assumed that this estimate is low for the following reasons. The PDSO/MAC percentage breakdown of processing functions, from the Operations Table (Table 16), should closely agree with the eventual processing functions breakdown of the MAC CMPS because of the similar nature of personnel and military pay systems. The MAC CMPS will use the identical hardware used by PDSO/MAC, and their respective workloads are the same, since PDSO/MAC was selected by the Operations Experience Index. Therefore, because PDSO/MAC uses approximately 89 hours per month, the proposed 50 hours per month is probably low.

All indications, then, are that the MAC CMPS will probably require more hours for application production and will cost more than the proposed $4,900 per month.

e. Dollars Per Month of Hardware Cost for Program Maintenance

The indication from the amounts currently being spent for program maintenance by two of the systems selected by the Development Experience Index is that the proposed $392 per month is low.

The Application Program Maintenance Table (Table 17) relates that AMPS is not charged by the hour for program maintenance but is charged a basic monthly rental fee of $1,986 for a NCR 390 computer used exclusively for AMPS program maintenance.

From the Operations Table (Table 16) and the Cost Factors Table (Table 6) it is determined that PDSO/MAC program maintenance costs approximately $1,397 for 14 hours per month of H800 and H200 computer time. The MAC CMPS should agree quite closely with this, since the same hardware will be used by both systems. The number of hours proposed for program maintenance (three at HQ ADC), is probably low and should more closely agree with those required by PDSO/MAC. This follows from the similarity between the two systems indicated by other sections of this evaluation.

2. Reasonableness of Proposed Schedule

The proposal estimates that the MAC CMPS development will require 11 months with an additional 7 months required for implementation at the proposed 11 operational sites. The data retrieved from the systems selected by the Development Experience Index reveal that the development of the MAC CMPS can be realized within the proposed time frame.

a. Design, Programming, Checkout, and Test Schedule

The Schedule Table (Table 7) relates that two of selected systems required the following number of months for system design, programming, program checkout, and system test: AMPS, 12 months; and PDSO/MAC, 17. These two systems are given the most consideration because the MAC CMPS will replace AMPS, and PDSO/MAC was developed to operate at major air command headquarters and on the same hardware that the MAC CMPS will use.

Examination of the Personnel Table (Table 10) reveals that the AMPS development team included 23 system analysts who averaged 14.5 years experience in ADP and 21.5 years experience in military pay. This large, highly experienced team contributed to the short-duration system design for AMPS. The proposal estimates that eight system analysts will be required, averaging 9 years experience in ADP and 12 years experience in military pay. Since the Directorate of Military Pay at AFAFC was responsible for AMPS development, considerable transfer

of valuable experience and knowledge to the MAC CMPS should allow the system design to be handled within the proposed schedule.

The time required by PDSO/MAC for system design and programming would seem to be near what will be required by the MAC CMPS, because the personnel requirements for both systems are quite comparable (see Table 10). It is assumed, however, that the time required by the MAC CMPS will be slightly less than PDSO/MAC, since the hardware already exists for MAC CMPS, whereas PDSO/MAC was developed and the hardware was installed simultaneously. Furthermore, the PDSO/MAC efforts were somewhat paced by the concurrent PDSO/MPC and PDSO/CBPO efforts.

b. Site Implementation Schedule

Seven months for implementation at the 11 operational sites seems reasonable in light of AMPS implementation experience (see Table 7). MAC CMPS will require 11 installations in a period of 7 months, while AMPS required 125 in 10 months. (See Location section of AMPS in the handbook.) Also, the MAC CMPS implementations will be on existing hardware while the AMPS installations required installation of new hardware.

3. Reasonableness of Proposed Benefits

The MAC CMPS proposal indicates that approximately 400 base personnel may be eliminated through implementation of the proposed system. From AMPS Benefits Experience Data (Table 8) it is observed that AMPS proposed to eliminate approximately 1,200 military pay personnel at a saving of $6.0 million annually in personnel costs. From Table 8 it is seen that, in reality, only 240 personnel were saved because a great deal of military pay personnel time is involved in personal dealings. Since the military pay staff of the AFO's already has been reduced by AMPS implementation and since AMPS was not able to achieve the proposed personnel reduction because of the extensive face-to-face contact required, it does not appear that as many as 400 personnel can be eliminated.

The MAC CMPS proposal does not provide a sufficiently detailed analysis of base personnel savings. It is recommended that a pilot base be established to determine the potential personnel saving at base level. This pilot system should communicate via AUTODIN to a manually simulated Major Air Command Headquarters.

The MAC CMPS system is proposed to save $3.3 million per year by base personnel and computer elimination. If no base-level personnel saving can be realized, the net operational saving would be reduced to $1.3 million per year.

The proposed functional benefits, such as improved data handling methods for obligations accrued (no longer must paper tape be sent to AFAFC) and elimination of operational deficiencies, seem reasonable and should contribute to a more accurate and responsive accounting of military pay.

4. Potential Problem Areas

a. Organization

MAC CMPS is to be developed by the Directorate of Military Pay at the Air Force Accounting and Finance Center. From Table 9 it is observed that AMPS was developed by the Directorate of Military Pay in conjunction with the Directorate of Data Automation at the Accounting and Finance Center. Because MAC CMPS will use the same basic military pay procedures as AMPS, the organizational placement of the development effort will enable a considerable body of knowledge and related experience to be applied to MAC CMPS development.

It is proposed that MAC CMPS will be operated by the Directorate of Data Automation within each MAC. From Table 9 it is seen that PDSO/MAC is operational in the H800/200 system by the Directorate of Data Automation. MAC CMPS will thus be another application to be processed by an existing operations group. However, new communication (of technical material) channels between the developer, AFAFC, and the operators must be established.

b. Development Phase

(1) Personnel

The Personnel Table (Table 10) indicates the size and experience of the development teams for PDSO/MAC, RAFT, AMPS, SC/ACCT, and PDS. Examination of the relative efforts for program improvement versus program correction found in the Application Program Maintenance Table (Table 17) shows that RAFT, with 90 percent of the time spent on program corrections, suffered from an inexperienced development team. The other four systems had significantly more experienced development teams, resulting in less program correction effort. The MAC CMPS proposed development team is sufficiently experienced and should not encounter excessive program corrections if the proposed level of experience is maintained.

(2) Hardware

The MAC CMPS will use the same hardware used by PDSO/MAC. This use of existing hardware will eliminate the problems encountered by PDSO/MAC, AMPS, and PDS while simultaneously developing systems and installing hardware. However, PDSO/MAC has found it necessary to retrofit the basic PDSO system to the H800/200 computers that differ from MAC to MAC (see Table 17). It is quite likely that the MAC CMPS will encounter the retrofit problem.

(3) Software

The MAC CMPS will use software already existing at HQ ADC, AFAFC, and all operational sites (see Tables 11 and 12). Therefore, no problems are anticipated with software.

(4) Application Program Development

The proposed MAC CMPS development plan appears to have solved any location problems (see Table 14 for RAFT, which had a 300-mile distance between the programmers and the checkout hardware). The proposal suggests the use of AFAFC's RCA 501 to code check COBOL programs and indicates that HQ ADC might be used for program and system testing. Also, problems encountered by PDSO/MAC during development will not be encountered by the MAC CMPS because the hardware already exists and an inquiry system will not be developed (see Table 13).

(5) File Conversion

The proposed file conversion is to require three full-time personnel at each MAC for a 2- to 3-month period. This estimate is low when compared with the AMPS file conversion (see Table 14) which took from 15 to 40 personnel 2 weeks per base. However, the AMPS file conversion was manual to ADP while MAC CMPS is ADP to ADP, thus the estimate is felt reasonable.

The proposal contains no plan for procedures to be written to aid the various MAC Headquarters personnel in accomplishing a smooth file conversion. From Table 14 it is observed that PDSO/MAC produced two successful documents which specified procedures for file conversion. It is suggested that the file conversion procedure be thoroughly designed and include the preparation of procedures for conversion like those successfully employed by PDSO/MAC (see Table 14).

(6) Documentation

Since MAC CMPS will be standardized across all major air commands and will be sending reports to and inputs from base AFO's, it is particularly important that the system be adequately documented. From AMPS Documentation Experience Data (Table 15) it is observed that, although AMPS had exhaustive user documentation, it was not readily understandable to the operators. The MAC CMPS proposal contains no plan for documentation. It is suggested, therefore, that the MAC CMPS proposal be revised to include a documentation plan that will provide readily understandable documentation for inexperienced operators (observe from AMPS personnel data that average operator experience is only 2 years in ADP and 2 years in military pay).

c. Operations Phase

(1) Hardware

The Hardware Table (Table 11) relates that the H800/200 computers used by PDSO/MAC have been very reliable. Since these computers will be used by MAC CMPS at 10 of the 11 proposed operational sites, no hardware reliability problems are anticipated. The IBM 7080/1401 has also been operational at the remaining site, HQ AFLC, for some time; therefore, it should present no problems.

(2) Operations

The proposal indicates that a study of RCS-E6 reports shows that sufficient time is available for the addition of the MAC CMPS without new hardware acquisitions. However, the Operations Table (Table 16) relates that the H800 used by PDSO/MAC at HQ ATC is currently overloaded, and it is planned to augment the present configuration with another H800. This gives reason to suspect that other MAC Headquarters may also be overloaded, or near enough to capacity that the addition of another 70 hours could overload them. This possibility should be thoroughly explored before the proposal is approved.

(3) Application Program Maintenance

A large amount of program maintenance time is spent on AMPS (see Table 17) because of frequent legislative changes in military pay. Because of these changes, the MAC CMPS concept of a "computation file" with easily changeable basic algorithms appears to be well worth the cost of implementation.

PDSO/MAC had to be retrofitted to different H800/200 configurations (see Table 17). Since this is expected to be necessary for MAC CMPS, program maintenance personnel must be available for all H800/200 configurations.

(4) Personnel

Since the hardware already exists at all proposed operational sites, no operations personnel problems are anticipated.

D. Result of Evaluation

All five of the proposed costs fall well within the ranges established by the cost estimation iso-graphs and agree well with the expected values. The subjective evaluation reveals a likelihood that four of the five proposed costs are low.

The proposed number of computer hours for application production and program maintenance seems to be the most out of line, because of

the excessive differences between the proposed operational monthly hardware costs and those costs actually being incurred by systems selected as relevant to the proposed ADPS.

The proposed schedule appears to be consistent with retrieved experience.

The evaluation of the proposed benefits with retrieved experience data reveals that the projected cost savings may not be realized by the proposed MAC CMPS. This is based on the small personnel savings experienced by AMPS. The proposed functional benefits appear reasonable and should be easily realized.

Several potential problem areas appear to exist for the proposed MAC CMPS. The problem of differently configured H800/200 computer systems existing at the 11 MAC Headquarters should be fully resolved, and allowances should be made for system retrofitting to the different computer configurations. The proposed file conversion and documentation procedures appear insufficient for the magnitude of the proposed ADPS. Also, the sufficient availability of computer hours expressed by the proposal is questionable and should be clearly resolved.

It is concluded that the MAC CMPS proposal should be returned to AFAFC for further study and analysis and possible restatement of the proposed costs.

TABLE 6 - COST FACTORS EXPERIENCE DATA

A. Data Retrieved From ADPS Proposal

The MAC CMPS proposal estimates that 790 hours on the RCA 501 and H800/200 computers will be required for program checkout costing approximately $75,800.

The MAC CMPS proposal estimates that 290 man-months will be required.

The MAC CMPS proposal estimates that the hardware cost per month for application production will be $4,900 per MAC, and the hardware cost per month for program maintenance will be $392.

The MAC CMPS proposal estimates that four programmers will be required to maintain the system at AFAFC.

B. Data Retrieved From Handbook

Index	System	Retrieved Data
Dev. Exp. File Conv. Dec. Op.	PDSO/MAC	PDSO/MAC development required 489 man-months of development effort. PDSO/MAC program checkout required 1,300 hours on the H800 computer costing approximately $84,700.
Dev. Exp. File Conv.	AMPS	AMPS development required 704 man-months of development effort. AMPS program checkout required 3,744 hours of NCR 390 computer time costing approximately $37,178.
Dev. Exp.	PDS	PDS development required 267 man-months of development effort.

TABLE 6 (Continued)

Index	System	Retrieved Data
Dev. Exp. Dec. Op.	SC/ACCT	SC/ACCT development required 226 man-months of development effort.
Op. Exp.	GE/BSS	GE/BSS currently averages eight operations personnel per operational site. The GE/225 computers used only by GE/BSS are rented on a basic monthly rental charge of $9,400 for each computer per month, regardless of the number of hours used.
Op. Exp. Dec. Op. Proc. Type	PDSO/MAC	PDSO/MAC currently has seven operations personnel allocated to the system at Hq. ATC. PDSO/MAC's hardware cost per month is approximately $10,457 at Hq. ATC where program development and maintenance is done for all operational sites.
Op. Exp.	RAFT	RAFT required three operations personnel during its operational phase. RAFT's hardware cost per month was approximately $8,775 at Sheppard AFB for application production only.
Dev. Exp.	PDSO/MAC	PDSO/MAC program maintenance requires nine personnel and uses approximately 14 hours of H800 time per month.
Dev. Exp.	AMPS	AMPS program maintenance requires 10 personnel and uses approximately 176 hours of NCR 390 time per month.

TABLE 6 (Continued)

Index	System	Retrieved Data
Dev. Exp.	PDS	PDS program maintenance requires seven personnel and uses approximately 6 hours of the dual processor RCA 301 time per month at SMAMA.
Dev. Exp.	SC/ACCT	SC/ACCT program maintenance requires two personnel and uses approximately 28 hours of IBM 1410 time per month.

TABLE 7 - SCHEDULE EXPERIENCE DATA

A. Data Retrieved From ADPS Proposal

The MAC CMPS proposal estimates that the MAC CMPS development phase will require 11 months. Implementation at the 11 operational sites will require an additional 7 months.

B. Data Retrieved From Handbook

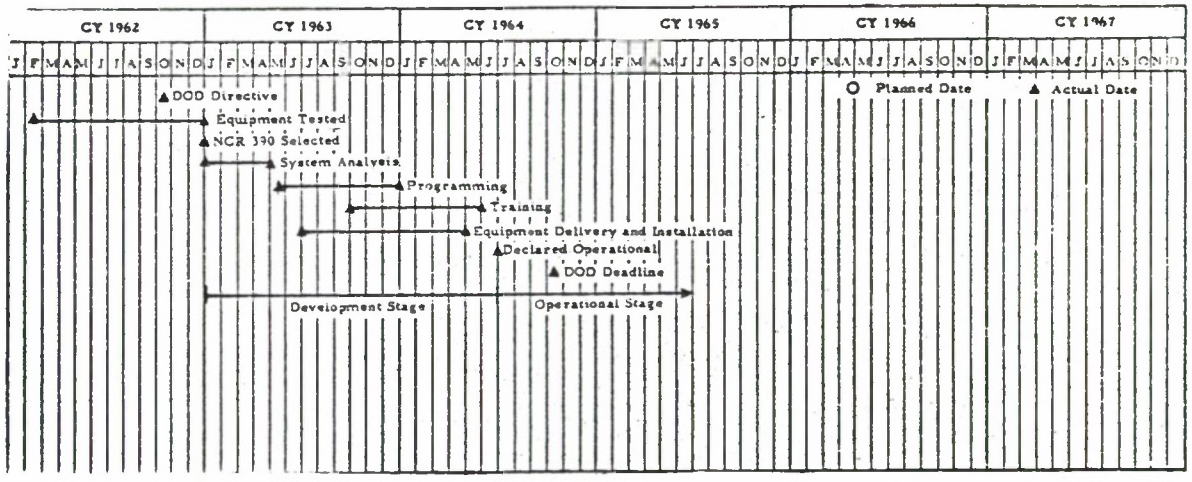
Index	System	Retrieved Data
Dev. Exp. File Conv.	AMPS	
Dev. Exp.	PDS	The PDS development phase required 18 months, with the proposed development phase set at 16 months. The implementation of the seven AMA's and Hq. AFLC required an additional 7 months.

TABLE 7 (Continued)

Index	System	Retrieved Data
Dev. Exp. Dec. Op. File Conv.	PDSO/MAC	PDSO/MAC development phase required 22 months with 17 months required for systems design, programming, and system test.
Dev. Exp. Dec. Op.	SC/ACCT	The SC/ACCT development phase required 12 months. Implementation at the remaining other sites required 17 additional months.
Dec. Op.	DSWC	DSWC implementation at all sites required approximately 3-1/2 months to complete.

TABLE 8 - BENEFITS EXPERIENCE DATA

A. Data Retrieved From ADPS Proposal

It is proposed that the Centralized Accrued Military Pay System have the following benefits:

- A manpower reduction of approximately 400 base personnel, currently operating AMPS, resulting in a saving of $2 million per year.
- Elimination of the NCR 390 systems with a saving of $4.3 million per year. Additional expenditures include additional rental hours of Honeywell 800 or IBM 7080 at the MAC Headquarters costing $1.2 million per year and communication and PCAM equipment at the bases costing $1.8 million per year. This results in a net saving of $3.3 million per year.
- Provision of improved data handling methods for obligations accrued, making possible more frequent reconciliations of deductions and those amounts paid by the Air Force. The net saving that this would accrue is not known at this time.
- Elimination of operational deficiencies imposed by memory limiations, slow operating speeds, and inflexibility to changing military pay requirements, existent in the present system.

B. Data Retrieved From Handbook

Index	System	Retrieved Data
Dev. Exp. Funct. A.	AMPS	Proposed: Benefits which AMPS was designed to provide that the existing manual system did not provide include: (1) Reporting of military pay accounting information on an accrual basis to the Director of Personnel Planning and the Director of the Budget, (2) more timely reporting of military pay accounting, FICA, and FITW data, and (3) a net cost saving of approximately $1.7 million annually. This was justified

TABLE 8 (Continued)

Index	System	Retrieved Data
Dev. Exp. Funct. A.	AMPS	on an estimated saving of approximately 1200 military pay personnel. The personnel saving would be $6.0 million while added machine rental and maintenance would be $4.3 million, resulting in a net saving of $1.7 million annually. Actual: (1) Reporting of military pay accounting information on an accrual basis to the Director of Personnel Planning and the Director of the Budget was accomplished, (2) more timely reporting of military pay accounting, FICA, and FITW data was accomplished after some initial problems with the AMPS computer system and operations personnel, and (3) revised manpower requirements permitted the elimination of only approximately 240 personnel corresponding to about $1.2 million annually. Since additional equipment costs were $4.3 million, this resulted in a net annual additional cost of $3.1 million over the existing manual system.
Dev. Exp. Op. Exp. Dec. Op. Prog. Lang.	PDSO/MAC	PDSO/MAC proposed to standardize personnel systems across major air commands, and result in a significant cost reduction in personnel data handling. PDSO/MAC has provided increased responsiveness to commanders and management in the creation, edit, control, retrieval, distribution, and display of personnel data. Personnel systems are standardized across major air commands and standard data elements were adopted throughout the vertically integrated system.

TABLE 9 - ORGANIZATION EXPERIENCE DATA

A. Data Retrieved From ADPS Proposal

The MAC CMPS will be operational at 11 MAC Headquarters which will service the bases in those commands. The system will be operated by the Directorate of Data Automation within each MAC. The users of the system will be base Accounting and Finance Offices (AFO's), the Air Force Director of Personnel Planning, and the Director of the Budget. It is proposed that a System Development Project be established and that the Directorate of Military Pay be designated to direct the project Data System analysis and design would be performed at the Air Force Accounting and Finance Center (AFAFC) and at Headquarters ADC, where an H800/200 computer is available.

B. Data Retrieved From Handbook

Index	System	Retrieved Data
Op. Exp. Dec. Op. Mult. App.	PDSO/MAC	PDSO/MAC is operational at eight MAC Hqs. which service the bases in those commands. PDSO/MAC is operated by the Directorate of Data Automation within each MAC. The users of the system are the Management Information Office in each MAC, the Consolidated Base Personnel Offices of the bases within each MAC, and the MAC Military Personnel Center Branch within the Directorate of Personnel Data and Records of the Hq. USAF's DCS/Personnel.
Dev. Exp.	AMPS	AMPS was developed at AFAFC by a joint effort of the Directorates of Military Pay and Data Automation.

TABLE 10 - PERSONNEL EXPERIENCE DATA

A. Data Retrieved From ADPS Proposal

The MAC CMPS proposal estimates that 8 system analysts and 20 programmers will be required to develop the system.

The system analysts should average at least 9 years' experience in ADP and 12 years' experience in military pay. The programmers should average at least 5 years' experience in ADP.

The MAC CMPS proposal estimates that five operators will be required to run the system.

B. Data Retrieved From Handbook

Index	System	Retrieved Data
Dev. Exp. Funct. A.	AMPS	AMPS development required 5.3 managers, 23 system analysts, and 22 programmers. The managers averaged 12.5 years' experience in ADP; the system analysts averaged 14.5 years' experience in ADP and 21.5 years' experience in military pay; and the programmers averaged 4 years' experience in ADP.
Dev. Exp.	PDS	PDS development required three managers, six system analysts, and nine programmers. The managers averaged 8 years' experience in ADP; the system analysts averaged 5.5 years' experience in ADP and 5 years' experience in logistics; and the programmers averaged 7 years' experience in ADP.
Dev. Exp. Dec. Op. Prog. Lang.	PDSO/MAC	PDSO/MAC development required 18 programmers, 7 system analysts, and 3 managers. The programmers averaged 9.5 years' experience in ADP; the system analysts averaged 8 years' experience in ADP and 14.5 years' experience in personnel; and the managers averaged 11 years' experience in ADP.

TABLE 10 (Continued)

Index	System	Retrieved Data
Dev. Exp. Dec. Op.	SC/ACCT	SC/ACCT development required 2 managers, 3 system analysts, and 14 programmers. The managers averaged 7 years' experience in ADP; the system analysts averaged 17 years' experience in ADP and 17 years' experience in accounting; and the programmers averaged 1/2 year's experience in ADP.
Op. Exp.	GE/BSS	GE/BSS currently has an average of eight operators per operational site allocated to the system.
Op. Exp. Dec. Op. Prog. Lang.	PDSO/MAC	PDSO/MAC currently has seven operators at Hq. ATC allocated to the system.
Op. Exp. Funct. A. Prog. Lang.	RAFT	RAFT had 2.4 operators allocated to running the system on the basis of hours used by RAFT during its 18 month operational phase. RAFT development required 3 managers, 7 system analysts, and 14 programmers. The managers averaged 1 year of experience in ADP; the system analysts averaged 2 years' experience in ADP, 7 years' experience in accounting; and the programmers averaged 1.5 years' experience in ADP.

TABLE 11 - HARDWARE EXPERIENCE DATA

A. Data Retrieved From ADPS Proposal

The MAC CMPS will be operational on existing equipment. The central computer will be the Honeywell 800 at all MAC's except the IBM 7080 at AFLC. The RCA 501 at AFAFC will be used only to code check the COBOL programs.

B. Data Retrieved From Handbook

Index	System	Retrieved Data
File Conv. Op. Exp. Dec. Op. Proc. Type Prog. Lang.	PDSO/MAC	PDSO/MAC uses the Honeywell 800/200 computers common to most MAC Hqs. The H800 add time is 24 μs. The Honeywell 800 computer used by PDSO/MAC at Hq. ATC has 7 magnetic tape units and an internal storage capacity of 12,000 words. The Honeywell 200 computer has 4 magnetic tape units, 2 printers, and an internal storage capacity of 8,000 words. The delivery of the hardware was two months late. The hardware has proved to be very reliable.
Op. Exp. Proc. Type Prog. Lang.	RAFT	RAFT was operational on the RCA 301 computer which has an add time of 98 μs.
Prog. Lang.	MAFR	MAFR is operational on the RCA 501 computers at AFAFC.
Op. Exp.	GE/BSS	The GE 225 add time is 36 μs.

TABLE 12 - SOFTWARE EXPERIENCE DATA

A. Data Retrieved From ADPS Proposal

All new MAC CMPS programs for the H800 and IBM 7080 will be written in COBOL. This will result in lower programmer cost per instruction, and will allow interchangeability of programs among the various machines involved: the H800, IBM 7080 and the RCA 501 at AFAFC where initial checkout will be performed. The assembly languages used will be ARGUS for the H200 and AUTOCODER for the IBM 1401.

B. Data Retrieved From Handbook

Index	System	Retrieved Data
Dev. Exp. Op. Exp. Mult. App. Prog. Lang. Proc. Type	PDSO/MAC	Most of the PDSO/MAC programs were written in COBOL 61 except for several inquiry programs written in ARGUS, the assembly and macro-language, for efficiency in operation.
Op. Exp. Prog. Lang. Proc. Type	RAFT	All RAFT programs were written in COBOL.
Prog. Lang.	MAFR	The COBOL compiler used by MAFR on the RCA 501 at AFAFC was well debugged and gave no problems.
Mult. App. Prog. Lang. Proc. Type	DSWC	DSWC uses Autocoder for both IBM 7080 and IBM 1401 programs.

TABLE 13 - APP. PROG. DEV. EXPERIENCE DATA

A. Data Retrieved From ADPS Proposal

It is proposed that a System Development Project be established and that the Directorate of Military Pay be designated to direct the project. Data system analysis and design would be performed at the Air Force Accounting and Finance Center (AFAFC) and at Headquarters, ADC, where an H800 computer is available. System checkout will take place at a MAC Headquarters with a sufficient excess of H800 computer time to accomplish the job with minimum interruption of other functions. It is suggested that this be at HQ ADC due to its proximity to AFAFC. Data System Specifications will be prepared and submitted to HQ USAF for review and approval. The MAC CMPS will operate at the following headquarters of the major air commands: SAC, TAC, ADC, ATC, USAFSS, USAFE, PACAF, AFLC, MAC, AFSC, and HEDCOM. Except for AFLC, each MAC Headquarters has an operational Honeywell 800/200 system configuration. AFLC has and IBM 7080/1401. The MAC CMPS will use this existing computer hardware for both development and operations.

B. Data Retrieved From Handbook

Index	System	Retrieved Data
Dev. Exp. Funct. A.	AMPS	AMPS was developed by AFAFC. The programs were written in absolute machine language. The AMPS development was a cooperative effort of the Directorates of Military Pay and Data Automation within AFAFC. The Directorate of Military Pay was responsible for analysis and determination of military pay requirements and AMPS design. The Directorate of Data Automation was responsible for program design, coding and program check-out.

TABLE 13 (Continued)

Index	System	Retrieved Data
Dev. Exp. Dec. Op. Prog. Lang.	PDSO/MAC	The Personnel Data Systems Division of the Military Personnel Center was responsible for the development of PDSO/MAC. Twenty experienced programmers code assigned the system analysis and programming tasks required for PDSO/MAC development. These personnel were divided into one team responsible for file maintenance programs and another team responsible for development of file inquiry programs. System design of PDSO/MAC required close coordination with PDSO/MPC and the CBPO systems, since these systems are all part of the AF vertically integrated personnel data system. All three systems work with the same data elements and thus consistency in format and handling had to be maintained across development of these systems. PDSO/MAC system design commenced prior to the selection of the H800/200 computer hardware. The system designers had assumed a variable word length machine concept which required reorientation on the selection of the H800. PDSO/MAC-65 evolved from PDSO-63. Some PDSO-63 programs were modified and adapted to PDSO-65. PDSO/MAC programs were written in COBOL with the exception of several inquiry programs written in ARGUS, assembly and macro language, for efficiency in operation.
Funct. A Prog. Lang.	RAFT	RAFT programmers were trained at RCA 301 programming school, prior to the start of programming. Due to the 300 mile distance between the programming location and the checkout computer, the checkout was not begun until programming was virtually completed.

TABLE 14 - FILE CONVERSION EXPERIENCE DATA

A. Data Retrieved From ADPS Proposal

The MAC CMPS proposal estimates that file conversion will require 2 to 3 months for each MAC using 3 full-time personnel at each MAC.

All the files of this sytem must be created from scratch. Fortunately, the format of the MPR's will be very similar to the military pay record (magnetic strip) of the Accrued Military Pay System. Thus, the NCR 390's can be used to convert the existing files to punched cards which can then be converted to magnetic tape.

B. Data Retrieved From Handbook

Index	System	Retrieved Data
Dev. Exp. Funct. A. File Conv.	AMPS	File conversion for AMPS was made from manual payroll records to magnetic ledger report forms. A typical base file conversion process required two weeks using 15 to 40 personnel.
Op. Exp. Funct. A	RAFT	RAFT received inputs from bases via AUTODIN and produced paychecks for civilian personnel. RAFT file conversion was a manual to punched card operation with the punched card data being sent to the region via AUTODIN. A problem did arise when it was discovered that the AUTODIN equipment at the bases could not send or receive credit zeros.

TABLE 14 (Continued)

Index	System	Retrieved Data
Dev. Exp. Op. Exp. File Conv.	PDSO/MAC	A separate organization entity was created to plan the file conversion activities. The conversion consisted mainly of changing formats and code to conform with the vertically integrated system. Much interfacing with MPC and CBPO existed. Media included both cards and tapes. A team of four was used for 12 months to do the planning, programming, and interfacing. Two thorough documents were produced specifying procedures for MAC's and CBPO's. These procedures spelled out in details the flow of information, the changes in codes, the media used, the responsible organizations, pre and post conversion activities, the timing of conversion the audits and checks to be applied. In addition, the team oriented MAC and CBPO personnel on these procedures through personal visits to the sites. The conversion was accomplished very smoothly. The computer time used was not identifiable and is included in the checkout hours.

TABLE 15 - DOCUMENTATION EXPERIENCE DATA

A. Data Retrieved From ADPS Proposal

None.

B. Data Retrieved From Handbook

Index	System	Retrieved Data
Dev. Exp.	AMPS	The basic system description and user's manual is very voluminous and exhaustive. Effort is presently being expended to make the material of this manual more readily understandable. The basic documentation of AMPS programs and program operation is AF 171-15. This document contains program narratives, detailed data formats, flow charts, and program operating instructions. When a change is made to a program affecting AF 171-15, a change sheet for insertion or replacement is provided to all bases along with a new program tape. Any changes to the programming system are originated by an "ADP Projects Request/Authorization" form, which is signed and approved by responsible parties in both the Directorates of Military Pay and Data Automation.
Dev. Exp. Op. Exp. Dec. Op.	PDSO/MAC	Program and system documentation conformed to standards specified in AFM 171-10.

TABLE 16 - OPERATIONS EXPERIENCE DATA

A. Data Retrieved From ADPS Proposal

The MAC CMPS proposal estimates that 50 hours of H800 or IBM 7080 computer time and 50 hours of H200 or IBM 1401 computer time will be required for application production per month. The proposal also estimates that program development and maintenance will require 3 hours per month at Hq. ADC, and 1 hour per month at each operational MAC Hq. on the H800 or IBM 7080.

B. Data Retrieved From Handbook

Index	System	Retrieved Data
Op. Exp.	GE/BSS	GE/BSS is the only application on the GE 225 computer. GE/BSS application production during a representative month at Scott AFB required 176 hours. GE/BSS program development and maintenance is done only at Scott AFB where 75 hours were used for that activity during the same representative month. Approximately 70 percent of the application production hours on the GE 225 computer is for file maintenance with 25 percent for report generation.
Op. Exp. Mult. App. Proc. Type	PDSO/MAC	PDSO/MAC application production during a representative month at Hq. ATC required 89 hours on the H800 computer. PDSO/MAC program development and maintenance required 14 hours on the H800 during a representative month. PDSO/MAC application production hours are distributed among the following processing functions: input edit, 7%; file maintenance, 18%; query, 18%; sort, 22%; merge, 3%; compute, 1%; and report generation, 31%.

TABLE 16 (Continued)

Index	System	Retrieved Data
Op. Exp. Mult. App. Proc. Type	PDSO/MAC	The H800 computer at Hq. ATC is currently overloaded and it is planned to add another H800 to the present configuration.
Op. Exp. Proc. Type	RAFT	RAFT used approximately 126 hours per month for application production on the RCA 301. RAFT application production hours are distributed among the following processing functions: input edit, 17%; file maintenance, 33%; query, 2%; sort, 3%; merge, 6%; compute, 13%; and report generation, 26%.

TABLE 17 - APP. PROG. MAINT. EXPERIENCE DATA

A. Data Retrieved From ADPS Proposal

The MAC CMPS proposal estimates that 3 hours per month at Hq. ADC and 1 hour per month at each MAC will be used for program maintenance on the computers, with 2 analysts and 2 programmers allocated to program maintenance.

B. Data Retrieved From Handbook

Index	System	Retrieved Data
Dev. Exp. Funct. A.	AMPS	AMPS Program maintenance is centrally located at AFAFC on an NCR 390 used exclusively for program maintenance an average of 176 hours per month performing 5% corrections, 25% improvement, and 70% changes due to legislative requirements. Eight programmers, one analyst, and one manager are currently allocated to AMPS prog. maint. at AFAFC.
Dev. Exp.	PDS	There are currently seven programmers involved full-time in program maintenance at Hq. AFLC and two programmers at SMAMA devoting 75% of their time to PDS. Current programming activities are rewriting programs to allow more efficient use of the disk, and reprogramming to include back orders on the PDS master file.
Dev. Exp. Dec. Op. Prog. Lang.	PDSO/MAC	PDSO/MAC is operational at the following eight MAC Hqs.: SAC, TAC, ADC, ATC, PACAF, USAFSS, USAFE, and HEDCOM.

TABLE 17 (Continued)

Index	System	Retrieved Data
Dev. Exp. Dec. Op. Prog. Lang.	PDSO/MAC	PDSO/MAC is centrally maintained at Hq. ATC. However, since the H800/200 computer configuration may differ from MAC to MAC, the personnel at each MAC Hq. retrofits the basic PDSO to their own computer configuration. Furthermore, each MAC Hq. may develop unique "add-ons" for their installation. All PDSO/MAC development programmers and analysts were phased into program maintenance which consists of 60 percent program improvements and 40 percent program corrections.
Dev. Exp. Dec. Op.	SC/ACCT	Two programmers are currently allocated to SC/ACCT program maintenance which is mostly program improvement rather than correction.
Prog. Lang.	RAFT	RAFT program maintenance required 3 full-time programmers involved with program corrections 90 percent of the time and program improvements 10 percent of the time.

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Security Classification

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Distribution of this document is unlimited.

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None	Directorate of Planning & Technology, ESD AF Systems Command L. G. Hanscom Field, Bedford, Mass.

13. ABSTRACT

This primer illustrates the use of the Air Force ADP Experience Handbook (Pilot Version) published under separate cover as ESD-TR-___ (PRC R-930). The use of the handbook is illustrated by first preparing a sample ADPS proposal and subsequently evaluating the proposal with experience data retrieved from the handbook. The sample ADPS proposal is written to a set of ADPS proposal submission instructions that are advanced as an improvement over existing submission instructions. The ADPS proposal submission instructions are included in the primer for completeness. The sample ADPS proposal is for a Major Air Command Centralized Military Pay System. The proposal is hypothetical in intent and content but has correspondence to a number of existing Air Force systems and procedures. Evaluation of the sample proposal involves first obtaining cost estimates and relevant experience data from the experience handbook. After all experience data relevant to the proposed ADPS has been retrieved, the sample ADPS proposal is evaluated in light of the retrieved data. The data in the pilot version experience handbook used for evaluation of the sample ADPS was based on a sample of 18 existing Air Force ADP Systems. The conclusion of the evaluation is that the proposal should be returned for further study and analysis of certain aspects.

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14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
1. Data Processing Systems 2. Classification 3. Abstracts 4. Measurement 5. Analysis 6. Effectiveness 7. Mathematical Models 8. Information Retrieval 9. Indexes						

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